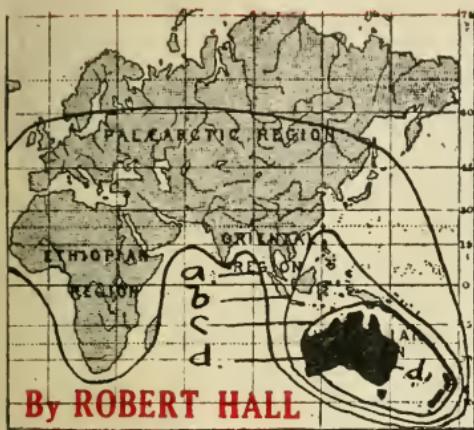




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AUSTRALIAN BIRD MAPS



By ROBERT HALL

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Australian Bird Maps

BY

59.82 (94)

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"Nature Studies in Australia" (Joint Author)



TO...

THE BOY SCOUTS
THE GIRL GUIDES

With any Profits that may occur



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FOREWORD

ALL the species of Australian birds do not frequent the whole of Australia. Many keep to the coastal scrubs, several to the hot areas of the north, and others to the equally dry areas of the south. Wherever the country conspicuously varies, a majority of the birds have some agreement with it.

The distribution of the present day species is the result of definite plans in populating this island-continent, amongst which we shall not fail to see an inner ring between central Australia and its coastline. This is the collateral zone of pallid species; offspring of the coastal species. Western Australia contains the main ends of the great plan (map 89).

The maps stand for the normal distribution of species and races, each area to be referred to as e.g. Queensland 3, Queensland 7³, etc. Messrs. Mathews and Iredale have contributed considerably to our knowledge of species; and sub-species, my races. Cayley's great work in the press will add newer ground. The pages of the "Emu" are the foundation in the making of these maps; and we have now an attempt at graph values in the natural distribution of Australian birds.

—R. H.

DESCRIPTION OF PLATES

PLATE 1

Maps—Black-faced Cuckoo-Shrike, 6; Whimbrel, 6; White-shouldered Caterpillar-eater, 6; White-rumped Wood Swallow, 8; Tern, 9; White-shafted Fantail, 19; Restless Flycatcher, 20; Grass Warbler, 24; Mountain Thrush, 25; White-throated Tree-creeper, 28 and 82; Harmonious Shrike Thrush, 30; Ibis, 31; Magpie Lark, 32; Pied Robin, 34.

PLATE 2

Maps—White-fronted Chat, 35; Crescent Honey-eater, 36; Cormorants, 45; Striated Grass Wren, 47; Black-fronted Dottrel, 52; White-eye, 54; Pectoral Rail, 57; Spotted Crake, 57; Little Greenshank, 61; Spotted Pardalote, 73; Moustached Honey-eater, 74; Noisy Miner, 74; Bee-eater, 75 and 7.

PLATE 3

Maps—White-eared Honey-eater, 78; White-plumed Honey-eater, 79; White-fronted Scrub Wren, 84; Superb Warbler (Blue Wren) 85; Brown Flycatcher, 90; Ground Wren (Calamanthus) 91; White-face (Xerophila) 92; Bronze Cuckoo, 93; Stubble Quail, 93; Pipit, 98; White-browed Babbler, 99; Shrike Tit, 99.



PLATE 1.



45.



47.



36.



35.



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52.



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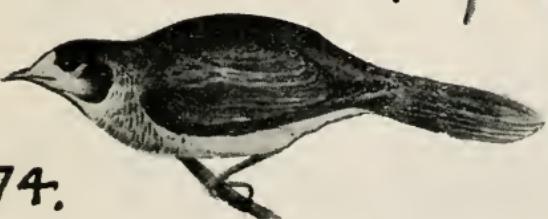
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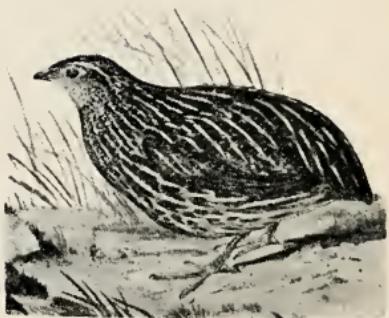
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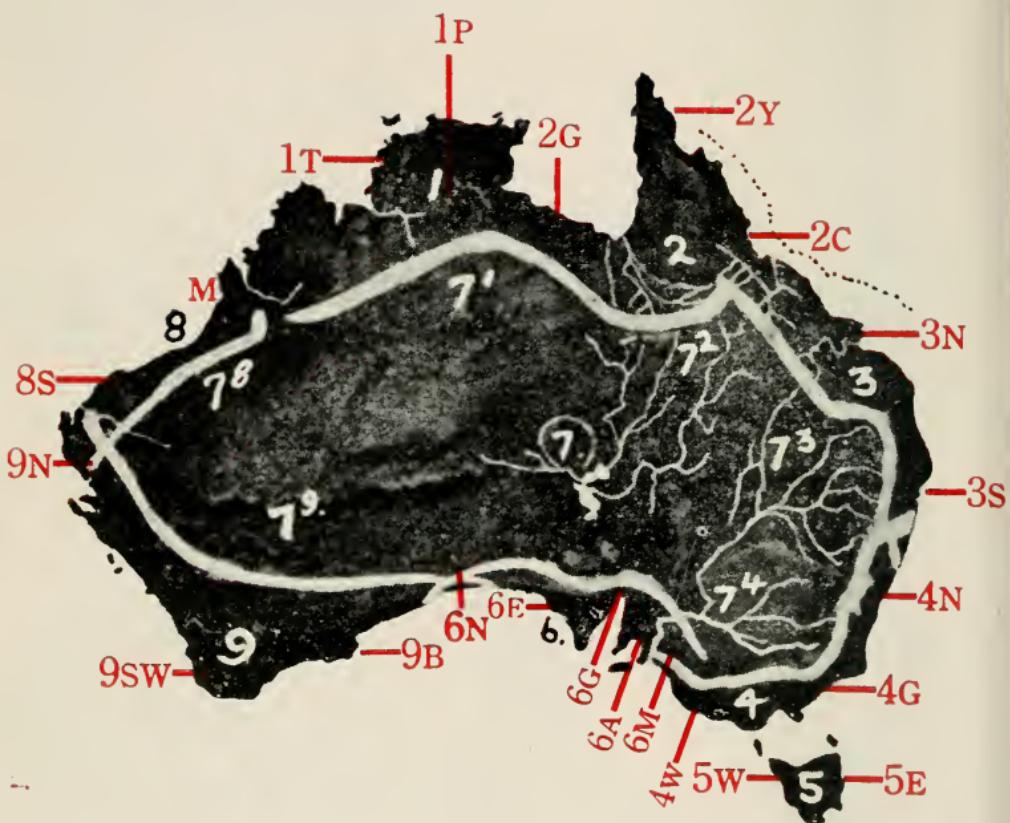
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MAP 1

Areas of Distribution.

1—6, 8, 9, Coastal Zone.

7, Central Zone.

7¹—7⁹, Collateral Zone.

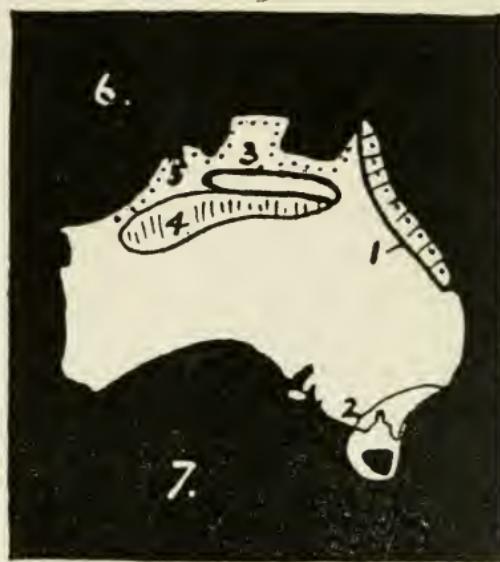
Sub-divisional Areas in Red

INTRODUCTION

THE zoogeography of Australia, for all practical purposes, comes under two heads. It has a fauna on the northern and eastern coasts in conjunction, or it extends over the greater portion of the continent. The climatic conditions are so slightly variable, yet so many, as to make innumerable races.

There is the coastal zone map 1, 1—5, 6, 8, 9, with clearly marked species, while within two hundred miles of the coast these species begin to change in shade of colour, and show a collateral zone (7¹—7⁹). It is the action of a dry hot atmosphere on them and their surroundings, giving an inner circle of bird life; a ring of races.

This second continuous band fuses with—and is parent to the lessened life of Central Australia. The outer ring 1—6, 8, 9, so far as most of its land forms are concerned, appears to have begun its existence in area 2, on receipt of its early life from New Guinea. Its extension went outwards 2 to 4, and 2 to 8. From 4 the birds gradually travelled to 5 and to 9.



MAP 2
Colour and Colour Scheme.

1. Birds of finest colour and plumage (Paradiseidæ)
2. The darkest plumaged birds.
3. The palest plumaged birds.
4. Desert tinted with extensions into the central area.
5. A 4,000 mile line of mangrove tidal habitat and tint.
6. Sea birds of the north; æsthetic colour pattern.
7. Sea birds of the south; dull colour pattern.

Along these lines of expansion there are certain breaks, over which many birds do not pass. The Hawkesbury River system is one, and Bass Strait another; the first of forest foods, the second a water barrier.

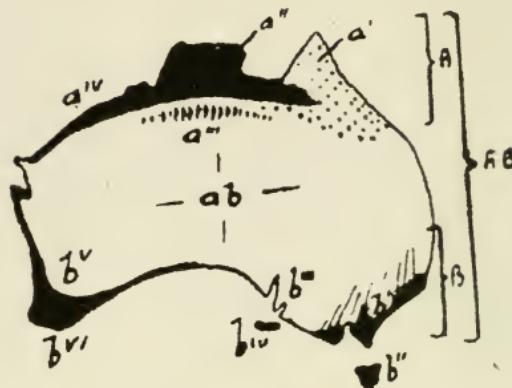
In the north the birds of area 2 could easily travel to area 1, after which a break in type of forest occurs. Many species, however, journeyed in the region of the North-West Cape (southern 8), and there came to a stand against a desert barrier.

Avifaunal areas show difference at once, and Australia the sub-region is colour stamped. Map 2 presents seven colour groups and colour schemes, the effect of moist or dry forests, and of variable deserts.

In colour sorting of a large collection of birds from all parts of the continent three ground plans show. We see the rich metallic sheens of coastal Queensland and Northern Territory, then the dull grades of Victorian and Tasmanian coast land, and very prominently the pale birds of area 3 (map 2). Finally several ground tints of the varying areas of country of the great balance of the Commonwealth can be separated. A million pipits agree in colour with these different areas of land upon which they are living.

The colour pattern of the numberless sea birds*

*An Australian Bird Book, col. pls.; 1911, J. A. Leach, D.Sc.



MAP 3

The races of a species.

A B—The Species.

A—Small Race.

a¹ Stock.

a² Darker.

a³ Paler.

a⁴ Western influence on the species.

B—Large Race.

b¹ Stock.

b² Island dark races in relation with b¹.

b³ Pale race.

b⁴ Island Race in relation with b³.

b⁵ Western race.

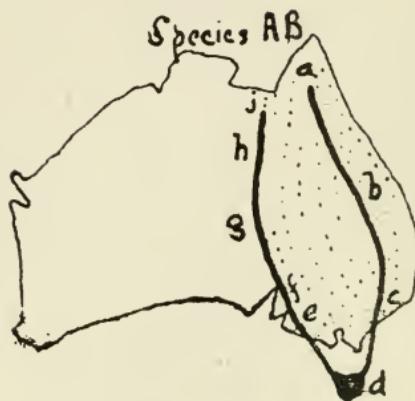
b⁶ South Western race.

along our northern coast is distinctly æsthetic, when compared with the sombre hues of as many million petrels that fringe the southern coasts.

Of the birds of Australia there are, say, eight hundred species with innumerable variations. Some of these latter may be considered races, and they are important in the ornis of this land. Take for example the species A B in map 3. A is the northern race, because all the thousands of it are smaller than B, those of the southern half of the continent. In each case the westward trend has taken the birds into western influences of food and air, and has changed their plumages. The colour pattern will mostly remain, while the intensity of colour will lessen and alter. This is noticeable in a³ of the race A, which comes under the paling effect of light desert air. A and B so carefully change in Southern Queensland as to be the intergrades.

In map 4, species A B is one example with eight races; Yellow-tailed Tit-Warbler (*Acanthiza chrysorrhoa*). Its southern expansion is a—d, and its western margin e—h.

While the birds of the southern line grow larger and darker, those of the same species of the western margin grow lighter, with elimination of certain plumage characters. The first line is in the damp belt, the second in the dry one, with an effect so gradual, yet so definite, as to give us birds at a—d.



MAP 4

An example of many broadly distributed birds with 8 races (Yellow-tail Tit-Warbler).

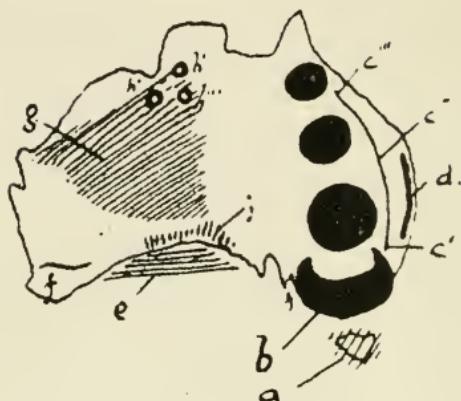
Species A B Races a—h.

- a. Smallest and Palest.
 - b. c. Intergrades.
 - d. Largest and Dullest.
 - e. Lower Murray River
 - f. Port Augusta.
 - g. Flinders Range.
 - h. Northern Australia.
 - j. Darker than h, due to moist coastal influence.
- } Races grading from dark to dull plumage

h—d different in their colour though similar in their colour scheme. These are parallel lines of plumage tint, one of which is subject to the darkening influence of the coastal ranges, and the other to the tendency directly or by natural selection to take out colour.

This is the main influence of the salt bush and other scrub lands between the Cloncurry and Wakool tracts. The tendency to lose colour from e to h is checked at j. Here we have the rapidly changed conditions of a mangrove coast: a portion of tidal vegetation extending four thousand miles along the northern fringes (map 2).

This brackish-mud feature is the outer line of other types of country. In the west, between the Ashburton and Gascoyne districts, there is an 8 inch annual rainfall, the dry belt extending inland a thousand miles. This is the barrier to the permanent northern species passing into south-west Australia, and for those of the south going north to the Kimberley country; rich in grass and insects. Such a bird as the bush lark (*Mirafra h¹ h² h³*, map 5) will hold its own in a parched province by agreeing in colour with its earth. The severe and varying food conditions of the northern country between the Ord and Flinders Rivers reacts on the frame of the bird by reducing it (b in map 5). As the same species is found south, the body is of larger proportion. The colour acting in an opposite



MAP 5

Some features of Australian Birds.

- a. Tasmanian forms are inclined to be larger than those of the same species on the mainland.
- b. Size decreases from south to north in same species, e.g. Red-browed Finch.
- c. Colour increases in intensity from south to north, e.g. Yellow Robin.
 - c¹ *Eopsaltria australis*.
 - c² *E. chrysorrhous*.
 - c³ *E. magnirostris*.
- d. Mountain colours are darker than those of the same species on the drier interior, e.g. Rufous breasted Whistler (*Pachycephala rufiventris*).
- e. Sunken portion of a continent severing the same types of birds between f and f, e.g. Bristle bird (*Sphenura*).
- g. A desert 8 inch rainfall as a barrier to certain birds. Birds coloured in keeping with the soil, e.g. *Mirafra* h¹ h² h³.
- j. A present day connecting link, Nullabor Plain.

direction increases in intensity southward. This is well shown in the east to west direction, (d map 5), by examining a series of Rufus-breasted Whistler (*Pachycephala rufiventris*). The mountain chain divides the darker race from the paler race, the latter being subject to less humidity.

A long stretch of country between the great rift valley and Eucla is composed of limestone, covered by salt bush and blue bush. This is a feeble connecting link, when compared with an earlier geological age, between the birds of South and West Australia. The Nullabor Plain, as the country is known, is the present connecting link of two avifaunal areas.

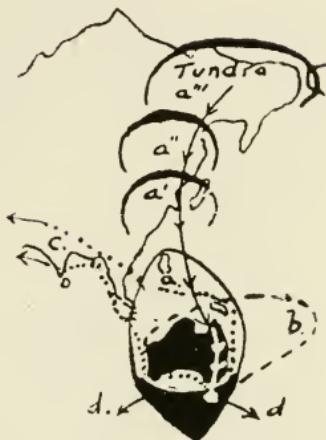
The distribution of certain species goes far beyond Australia. A few are found east in Polynesia, others north in the Phillipines group, and a further number, with their close relatives, in India (a, b, c, map 6). Shown as follows our birds are:—

Land: A. Internal. The thousand species and races truly Australian A¹ Forest, A² Grassed Plain, A³ Partial Desert.

B. External. Extra Australian migratory birds.

Sea: C. Vast colonies of petrel and gull families that rest on the mainland islands and live at sea.

Apart from distribution we have on a large scale, migration; the coming in from Siberia in Septem-



MAP 6
Broad Distribution.

- a. Black-cheeked Falcon (*F. melanogenys*).
 a¹ Snipe (*Gallinago australis*).
 a² White-rumped Swift (*Micropus pacificus*).
 a³ Whimbrel (*Numenius variegatus*).
- b. Shrike Thrushes (*Colluricincla*).
 Sacred Kingfisher (*Halcyon sanctus*).
- c. Cuckoo Shrikes (*Grauculus*).
 Grass Owl (*Tyto longimembris*) not S.W.A.
- d. Crested Penguin (*E. chrysocome*).
 Arrows indicate direction of nesting islands.

ber of a million birds. They are not truly Australian, though they live with us during six months of the year.

The young are reared in Northern Asia, and brought as far south as Tasmania to get away from the northern locking up of food.

Apart from this great migrating stream, a¹ a² a³ (map 6), there are minor doings in travel as under:

Daily migration: 1. Up and down valleys (New South Wales). 2. From range to sea (Queensland).

Bathic migration: Plains to higher mountains (Spring-autumn).

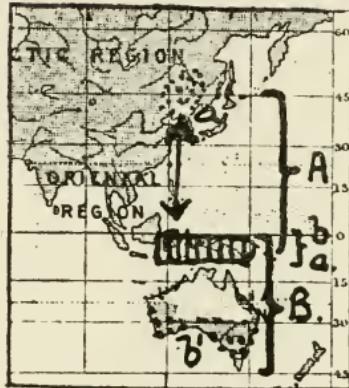
Partial migration: Annual e.g., Southern Victoria to Northern New South Wales.

Periodic migration: Subject to droughts and plagues.

Accidental migration: Internal and external.

Extra Australian: Within the Australasian Region e.g., from Port Augusta to New Guinea and islands.

Migration beyond Australia has its reverse side, as shown in map 7. A truly marvellous silent mass of life sweeps down from China and Transbaikalia into the Malay Peninsula and New Guinea after the summer of the northern hemisphere. This is in July. Also at that time thousands of southern Australian birds, wintering in New Guinea, leave



MAP 7

Reverse Migration.

- A—Southern Siberian and Chinese birds go to Malay Archipelago "a" to winter (Dec.).
- B—Southern Australian birds, b', go to Malay Archipelago, b, to winter (June).

New Guinea to travel south, either to the great gold-fields of Western Australia, the copper-fields of South Australia, or the country of the ancient sea of North-West Victoria. It is in September; their nesting season.

Next March the numberless flocks will move north again to New Guinea, just as the Chinese birds in New Guinea move back to their own plots in China, to nest.

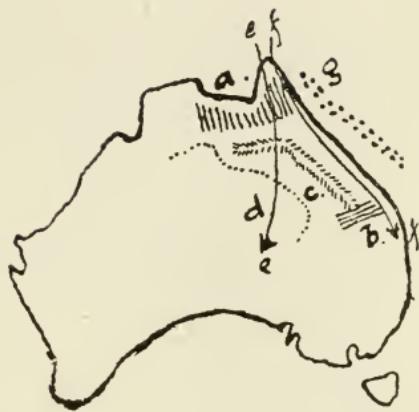
QUEENSLAND AND NORTHERN TERRITORY

Areas 1, 2, 3—7¹, 7², 7³

The State of Queensland is marvellously rich in shore birds. This is due to its thousand miles of adjacent coral reef, and good feeding grounds. Sea birds and waders mass. On land there is a tropical and an extra tropical fauna, each again being divided into dry country and coast line faunas (Map 8).

Queensland has a great annual immigration of birds from Papua, and a large emigration of another set to Southern Australia. In the Spring and Autumn, clouds of oversea migratory species pass. Examples of migration are as follows:—

Extra Australian—Siberia to Tasmania, annually via Queensland.



MAP 8

- a. Small forms of southern species b; also the strong-hold of the finches.
 - b. Species begin to blend with those of the same species (larger race) further south.
 - c. Mountain influences: west (paler): east (darker).
 - d. Interior and paler species.
 - e. Migration route to South Australia
 - f. Migration route to New South Wales
 - g. A vast ocean-reef avifauna.
- } From Papua

Trans-Continental—New Guinea to Spencer Gulf,
S.A.

Annual and regular in the State—North and South,
both coastal and inland.

Periodic and irregular—West to East in time of
big drought.

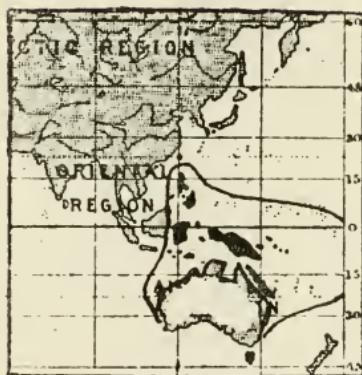
Nomadic in the Western part of the State in times
of minor droughts.

Coastal—insular: summer season.

So far as Australia is concerned, luxurious Queensland has sent over a large number of its species. Thus population has got to Victoria in the south, and the Northern Territory in the west. Out from this right angle a number of desert birds have gained their origin. They are the Eyrean species or races, while the coastal birds are the line of Tasmanian species.

In such a season as the present one, Queensland is magnificently grassed, and the Grass Finches multiply to an extent that gives a special feature to the fauna of the Commonwealth.

A dry spell coming, these great flocks make for higher ground with water and food. The water sheds are so arranged in the inner part of the north-eastern half as to be an asylum for millions of birds in dry seasons, and to an extent we can scarcely realise. They come in from the Diamantina, Thomson, Barcoo and Warrego parched country, sadly worn and needing the change.



MAP 9

A Great Coral-reef: approximate limits of its birds.

THE GREAT BARRIER REEF

(Plate 1, Fig. 9)

Innumerable shoals of small brightly-coloured fish pass in and out of coral reefs, being ever hunted by larger fish below, and graceful diving birds above.

Great flocks of a black looking tern (*Anous stolidus*), always on the watch, keep close and ever active in attack. The wonder is, that little fish have any peace.

Pelicans, White Reef-Herons, and Ospreys, however friendly, are intensely hungry things. Sandpipers, Godwits, Oyster-catchers and Night Herons are numerous in the landscape. Sandal-wood is useful to bird and man. While mangrove fringes the water, the Mangrove Kingfisher gives pretty movement to it. Thousands of Nutmeg Pigeons regularly roost in it; and whose monotonous note is broken by the screechings of as many Lorikeets (*Trichoglossus novæ-hollandiæ*). The white pigeons densely "blossom" the mangroves so as to give a most delightful picture along the reefs. Usually a Flying Fox is all that sees the charming sight of a long green belt in feathered snowy bloom.

Frigate-Birds, Sooties and Stints know these atolls and reefs, while the White-rumped Wood Swallow and Doves from the mainland rest upon their low herbage, and cocoanut palms. Pandanus palms also give sanctuary to nesting birds.



MAP 10

Affinity of Cape York Peninsula and New Guinea.

a. Blue-breasted Pitta (*P. mackloti*).

b. Noisy Pitta (*P. versicolor*).

b¹ Greater N.P. } Southern extension
b² Lesser N.P. } of family

c. Rainbow Pitta (*P. iris*) western extension.

Along the coral beaches the Sea Terns gather shells to make the name of nest. Some birds appear æsthetic enough to gather the more attractive shells.

The northern Gannets are numerous on the sand banks in spring, where they nest in rookeries. These are the vegetated coral-sand banks with growing pig-face, coarse grass, and low shrubs.

If disturbed, thousands of Terns will rise in a vast flock, leaving more thousands of young upon the ground. Early in the morning the parent birds go out to fish as a matter of food supply.

This mass of species is distributed very much as shown in Map 9. The strait between the islands of Bali and Lombok is not a barrier to sea birds as it has proved with land birds.

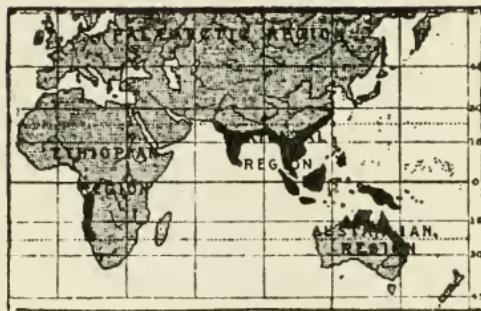
AFFINITY OF CAPE YORK PENINSULA AND NEW GUINEA

(Plate 1, Fig. 31; Plate 2, Fig. 7)

New Guinea is an island of more than ordinary interest, because of its position and mountain chains.

Eucalyptus forests stamp it as partly Australian and Birds of Paradise connect it with Cape York.

New Guinea has so large a list of wonderful birds as to be a little world in itself. When one considers the rich river flats, the hill slopes covered



MAP 11

New Guinea the birth-place of Australian Ant-Thrushes (Pittidæ): and broken distribution of the family.

by very varied vegetarian, and the snow capped ranges, it is readily judged to contain most interesting things in feathered life.

There are representatives of the Cassowary of Queensland, and there are the zoologically famous Australian mound building birds and the Sun birds.

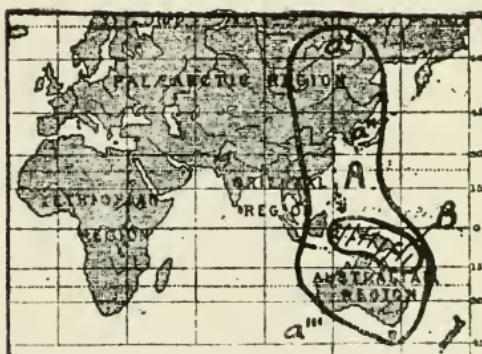
It abounds in colour and picturesque form, and is filled with the species of economic value that a country rich in vegetable products needs.

Certain of these useful birds pass backwards and forwards between Papua and Cape York Peninsula. There is the White Ibis, closely related to the Egyptian species, and the Spoonbill.

There are the Topknot and Nutmeg Pigeons, Bee-eater, Drongo Shrike, Channel-bill Cuckoo, the Black Cuckoo (*Eudynamis*) and the elegant White-tailed Kingfisher that nests in ant hillocks.

Pigeons feed largely on the fruits of the native fig. They are to be heard in the higher branches, though scarcely seen through the tangle of the under foliage. Thousands of birds on the ground beneath this leafy dome of thousands of acres make it their daily business to collect the fruits the "wasteful" pigeons drop. It is a world above a world, or a feathered stratum densely living above a ground stratum, equally alive and without much knowledge of its fellow. The law of mutual aid unconsciously is applied.

The Pittas or ant thrushes are amongst the most finely coloured tropic birds, and map 1 (a) indicates



MAP 12

Distribution of Australian Swifts (A).
Swiftlets (B).

a¹ Nesting ground of Fork-tailed Swift (*Micropus pacificus*).

a² Nesting ground of Spine-tailed Swift (*C. caudacuta*).

a³ Winter home of a¹ and a².

Papua as the recent birth-place of the Australian forms.

WIDE DISTRIBUTION OF A FAMILY

In maps 1 and 11 we have a highly coloured and dense forest family, very broadly distributed along three continents.

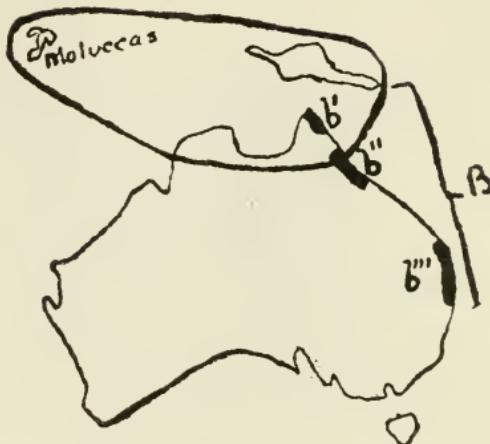
The Blue-breasted Pitta is common to New Guinea and Cape York Peninsula, keeping to the hot- rich, vine-scrub, feeding on shell snails and worms.

The Rainbow—and Noisy Pittas have their distribution as in Map 10.

The ant thrushes are a very old family judging by their dissimilarity of colour in Australia and by their isolation in West Africa. It is a little difficult to link Africa with India, and get the continuity. We have a similar case of a blue jay in Eastern Asia being practically the same as the one in Western Europe with no blue jay between. There is also the case of the Bristle-Birds in Southern Australia. Probably in all cases the original stock disappeared leaving the blank and the arms. The pittas in Australia are the latest extension from their birth-place in New Guinea.

Dense, hot, moist cane brakes are what the family prefer, and the tangle is almost impenetrable.

There are some fifty known species of which we



MAP 13

A—Australian Starling (*Aplonis metallica*) Moluccas and Queensland.

B—Rifle birds.

b¹ Magnificent Rifle Bird (*P. magnifica*).

b² Victoria Rifle Bird (*P. victoriæ*).

b³ The Rifle Bird (*P. paradisea*).

have four in Australia, and the colours throughout the family are blue, green, vivid scarlet, yellow, purple, black and white.

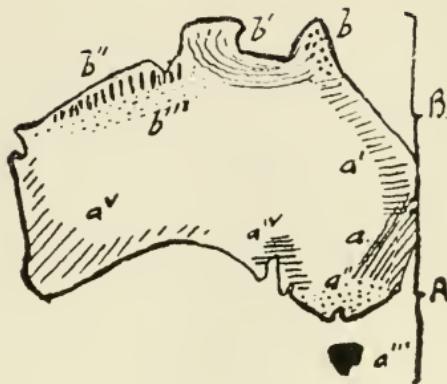
DISTRIBUTION OF SWIFTS AND SWIFTLETS IN AUSTRALIA

Tasmania is the southern limit and winter home of two species of swifts (map 12). Of these the "fork-tail" nests in Yakutsk, the centre of the extensive fur trade of central Siberia, while the "spine-tail" nests in Japan, Manchuria and Chosan (Korea).

The swiftlets live mostly in the Malay Archipelago about the Gulf of Carpentaria and the north-eastern coast of Queensland. Convergent evolution applies to swifts and swallows, while an examination of the hand and arm of each shows them not to be at all related. The swift has a long hand and a short arm, the swallow the opposite.

The Swifts are remarkably fine fliers and great insect eaters: feeding while on the wing. Their work is to reduce the swarms that spend the adult period of life high in the air. It is a fine provision of nature for certain species to feed on one plane and others elsewhere. A law for prevention of overlapping is found among the pasture feeding birds and the bush birds. Each pair patrols its own area in nesting season.

The swifts work through the law of mutual aid



MAP 14

Range of the Frogmouth (*Podargus strigoides*).

A—Tawny Frogmouth (Southern race) and its sub-races.

B—Freckled Frogmouth (Northern race) and its sub-races.

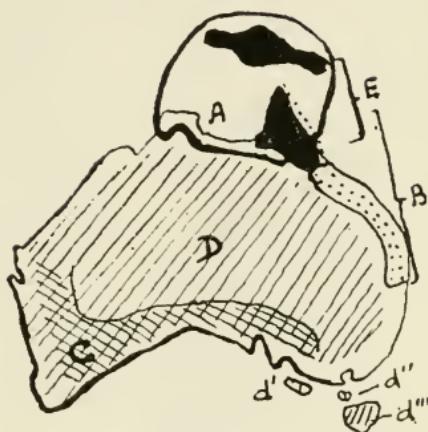
- a Tawny Frogmouth.
- a' Northern Tawny Frogmouth.
- a² Victorian Frogmouth.
- a³ Tasmanian Frogmouth.
- a⁴ Southern Frogmouth.
- a⁵ Westralian Frogmouth.
- b Freckled Frogmouth.
- b' Carpentaria Frogmouth.
- b² Western Frogmouth.
- b³ Mungi Frogmouth.

and by this means almost exterminate small swarms of insects.

Swiftlet-nests in household economy are considered valuable as soup makers to an enormous extent, and caves in oil bearing Borneo contain tons. On the Lena River in Siberia the Russians have a reverence for swifts because of their economic value as destroyers of noxious insects. If we ever wish to get to cross purposes with a Cossack, it can be done by interfering with the nests of a swift or swallow. The present writer can truly say his one experience of this particular form of anger just about cost him his life.

A. SHINING STARLING (Calornis)
B. THE RIFLE BIRD

A. The home of the Starling is shown in map 13, with an extension from the Solomon Islands to the Moluccas, and south—to New South Wales in certain seasons. It is stationary, or it may migrate between such attractive places as Cairns, Cardwell and Rockingham Bay. A flock will then build a colony of 50 to 300 pensile nests in the same cotton tree, or fig tree. This species is the only native of Australia of this old-world family. Even so it is confined to the coastal scrub of a portion. India and China are the headquarters of the family, which includes the common starling now introduced to Tasmania and the mainland. Fruit-



MAP 15

Mound Builders (A B C), Emus (D), and Cassowary (E):

- A—Scrub Fowl (*Megapodius reinwardt*).
- B—Brush Turkey (*Alectura lathami*).
- C—Mallee Fowl (*Leipoa ocellata*).
- D—Emus (*Dromaius*) d^1 d^2 d^3 Extinct.
- E—Cassowary (*Casuarius casuarius*).

growers find the family a mixed blessing. The Buphaga, a similar bird, of Zululand and the Transvaal is a valuable asset to that country in so far as it regularly accompanies the cattle, devouring the ticks. The Myna brought to Australia from the Bombay Presidency and the Punjab is another cheerful member.

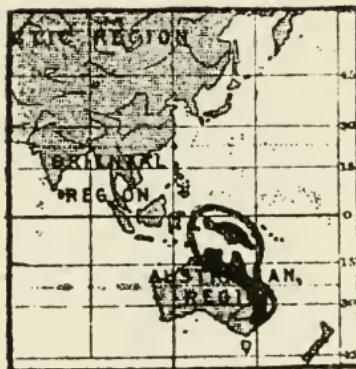
B. **The Rifle Birds** are the Birds of Paradise map 13, b¹ b² b³. They form the section together with Satin Bower Birds, that keep to the coastal scrubs. In New Guinea a species is found to live at 9,000 feet above sea level: in Queensland at 4,000 feet. The other section keeps to the dry portion of Australia.

Humming Birds and Rifle Birds have no equal as families dressed in the height of splendour and wonderful cut of garment.

In Batchian they have been known for centuries as Birds of the Gods. If we have ever seen gorgeous metallic butterflies floating through the soft air of a forest, sparkling like precious stones, we may just imagine the same lovely thing, much multiplied, in a forest of the Richmond River.

RANGE OF THE FROGMOUTH (*Podargus strigoides*) IN TWO RACES

An examination of the broad beak of this twilight bird at once indicates its kind. If we enquire for the most common species we find it is the Tawny shouldered with two races: a southern and a



MAP 16

Home of Wood Pigeons and Fruit Pigeons
(Treronidae and Columbidae: ten species).

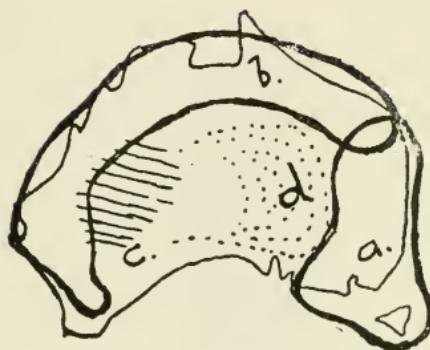
northern, falling in with one conspicuous way of distribution of many of the Australian birds (map 14 A B). A walk along the Derwent or Tamar Rivers, with a particularly observant eye, will show the darker race.

In group B we have in the Cape York Peninsula and about Croydon the smaller race which is again divided into a paler race at Tennant's Creek, N.T.

The nearest relative of the genus outside Australia lives in the Himalayas connecting with Australia about Java. Here it lives along the margins of the never ending rice fields. Frogmouths are silent harmless useful birds. They perform their services in orchard and forest in the gloaming as most careful insect patrols. The bird and its nest assimilate in colour closely with the tree, and can scarcely be detected. Why is the young sometimes rufous, giving us an hepatic phase?

MOUND BUILDERS AND EMUS

Plain coloured ground-birds may not attract like Rifle Birds, but they are quite as interesting. Map 15, A B C, shows the distribution of the Mound builders. Such a mass I have measured, with a diameter of fourteen feet and a height of three: composed of leafy rubbish with an immense amount of heat within it. This is a self incubating nest while the birds stand by acting as living thermometers and removing the top sand or replacing it



MAP 17

Races of the Bronzewing Pigeon
(*Phaps chalcoptera*).

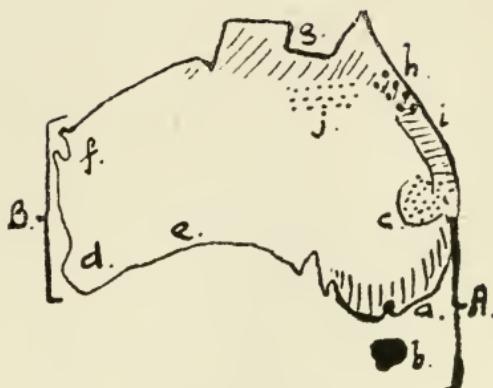
- a. Large sized race.
- b. Small sized race.
- c. Pale race.
- d. Nesting ground in a good food season.

as the temperature varies. Along Southern Australia in a great belt of mallee timber the silent Mallee Fowl is to be found.

In the north of the continent we have the Scrub Fowl (Megapode) and parallel with the east coast, as shown in the map the Jungle Turkey (*Catharturus*).

In family ways all three are much alike, the young hatching out and flying the following day. The eggs are specially large in order to supply food to develop the feathers before the bird leaves the egg to face the world. The Mallee Fowl lives in that portion of the Commonwealth which is dry and hot while the other mound nesters for centuries have occupied the moist, hot, coastal areas. Originally they built in trees judging by their free finger tips.

Emus keep out of the forest tangles while the next of kin the Cassowary lives exclusively within it on the Queensland coast. The Australian sub-region has only this one of nineteen species. The Papuan has the balance of which seven are found on New Guinea and eleven on the small islands of it. The geographical range of the only species of Emu is over D, of map 15. Some few years ago and in the memory of early explorers several other species lived. The Tasmanian d³ was the last to go. About this time d² of King Island disappeared and d¹ of Kangaroo Island. Those far away islands, the Galapagos, have forty-two species of



MAP 18

Rosella Group of Parrots.

- A—White cheeked Rosellas (Eastern representation):
- The Rosella (*Platycercus eximius*).
 - Tasmanian race of "a."
 - Darling Downs race of "a."
- B—Yellow cheeked Rosellas (Western representation).
- Yellow cheeked Rosella (*P. icterotis*).
 - Dundas race of d.
 - Red mantled race of d.
- C—Blue cheeked Parrots:
- Blue cheeked Parrot (*P. cyanogenys*).
 - Cooktown race of g.
 - Southern blue cheeked or Pale headed Parrot.
 - Pale rumped race of g (due to hot dry influence).

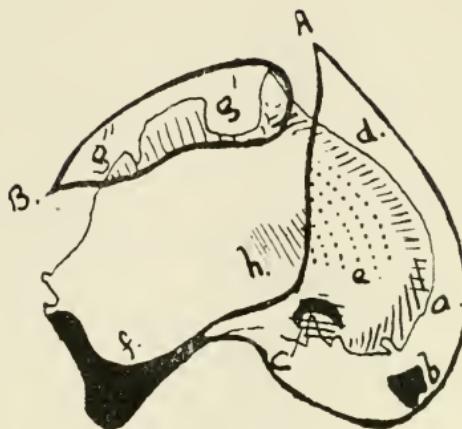
birds of which forty-one are not found elsewhere. This useful insect eating bird of Australia has an increasing number of enemies. The best provision for its protection should be enforced.

HOME OF THE FRUIT PIGEON AND WOOD PIGEON

The Nutmeg Pigeon is a remarkable bird and is the great factor in the distribution of the nutmeg seed. It migrates from New Guinea, and associates on the islands off Queensland in nesting season. During the evening hundreds of thousands settle on the mangroves and palms. Next morning one half of them fly rapidly across the sea to the mountains of the mainland, to return each evening. The sight of thousands of white birds rising together, or fluttering in the green belt of timber, is a very fine one. Hinchinbrook Island is a favourite place to witness the daily travel. It is a great nesting site. The nest is a flimsy structure just as with other pigeons.

The Topknot Pigeon, with a grey dress, is a more southern bird, and as an occidental, has got as far south as Tasmania.

The Red-crowned, Rose-crowned and Purple-crowned Fruit Pigeons inhabit the luxurious humid scrubs and unconsciously mimic the foliage of the trees in which they live; dark greens and rich purples.



MAP 19

The White-shafted Fantail and its races:

a—f Southern race.

g¹ g² Northern race.

h Central race.

a. White-shafted Fantail (*Rhipidura flabellifera*).

b. Tasmanian race.

c. South Australian race.

d. Littoral Queensland race.

e. Central Queensland race.

f. West Australian race.

g¹ Northern Pheasant Fantail

g² Western Pheasant Fantail (paler division of g¹).

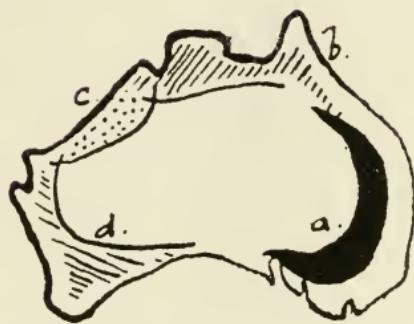
h. White-tailed race.

The Tweed River scrubs and the Cardwell district are favourite places with these birds, and fig trees abound. The fruit of this tree (*Ficus*) is their favourite food. High up in the branches, and apparently in another world, the birds feed and drop fruits far below to the ground-feeding birds of distinctly other species. These species mostly migrate annually between the Clarence River district and Cape York.

The White-headed Pigeon is our true wood pigeon, being found in New South Wales and Queensland; keeping to the dense moist hot scrubs and living in the trees, eating figs. It builds high, a feebly constructed nest, and lays one white egg.

RACES OF THE BRONZEWING PIGEON

The Bronzewing is a popular bird with sportsmen, though it is more interesting to those who carry the field glass. The pleasure is continually renewed. Map 17 shows "a." the area of distribution of the largest sized race. As one goes north to "b" the birds lessen in size, and we get the small race. In the desert of the great interior and westward, the colour of the ground has its effect upon the plumage of the birds. It is paler. This is a law in the distribution of Australian birds. If the climate of Central Australia is good, and the rainy season is just past, the pigeons will quickly extend their range of distribution into it, feeding and



MAP 20

The Restless Flycatcher (*Seisura inquieta*),
and its geographical races: a—d.

nesting at "d" till the next drought drives them out. Where the native cherry (*Exocarpus*) grows, they feed upon its fruit. Near the coast they associate in the belts of banksia and "oke," having a special love for the drier ridges of the open country. We are on first acquaintance likely to be confused by a species known as the Brush Bronzewing, which keeps much more to the forest country over the whole of the continent and Tasmania. Pigeons raise as many as three broods in a season, beginning to nest in September and continuing to March.

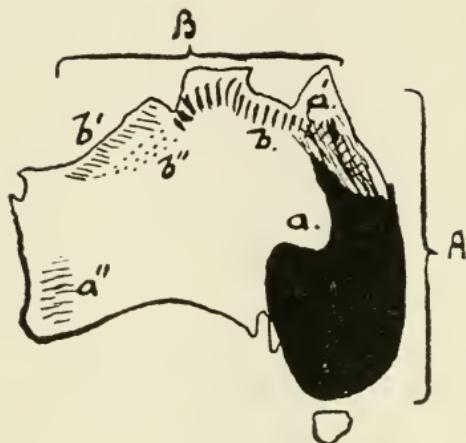
THE WHITE-SHAFTED FANTAIL AND ITS RACES

(Plate 1, Fig. 19)

There are three sections of this restless and familiar fantail (map 18) :—

- A. Southern
- B. Northern
- C. Central

The southern bird amongst the great mass of birds is best known by its friendly and fascinating ways, and by its elegant nest. It is a model along its own line of architecture; a most artistic structure. It may well be compared with the bowl of a pipe, tapering at the bottom to twice its own length. Cobwebs are densely worked about it and a felted symmetrical effect is the result. Then comes



MAP 21

Distribution of the Kookaburras or Great Kingfishers (Dacelo).

A—Eastern race:

- a Southern Great Kingfisher.
- a¹ Northern Great Kingfisher.
- a² Introduced into W.A. 1896 (a).

B—Northern race:

- b Blue-winged Great Kingfisher.
- b¹ Fawn-breasted Great Kingfisher.
- b² Mungi Great Kingfisher.

along the houseless cuckoo and drops in a bronze coloured egg, with the usual tragedy of the young to follow. The Southern and Western forms of "cranky fan" have white shafts to their tail feathers; the western bird of the karri and jarrah forests differing from the eastern in the paler breast band.

In map 19, "f" we find the Tasmanian race of darker plumage obeying the law of darker plumage on islands of high latitude.

The Central Australian bird has its outer tail feathers pure white, and it is found in the mulga scrub about the creeks of the ranges, e.g. Macdonnell Range. It has the typical eccentric action of flight, with a fan-like tail as it shoots out into mid-air and twists about, promptly returning with an insect captured on the wing.

The Northern Fantail is pheasant like in general appearance. The country it is partial to is mangrove fringes, teeming with mosquitoes and smaller insects. In the west, g² is a paler race of g¹.

THE RESTLESS FLYCATCHER AND ITS RACES

(Plate 1, Fig. 20)

A reference to map 20 will show the "scissors grinder" to be distributed all round Australia, but not in Tasmania. The birds of Tasmania are so



MAP 22

Distribution of the three large Cuckoos:

- a. Pheasant Cuckoo (*Centropus phasianus*).
- b. Channel-bill (*Scythrops novæ hollandiæ*).
- b' Visitor to Southern Victoria and Tasmania.
- c. Koel (*Eudynamus orientalis*).

closely related to those of the mainland as to be practically the same species. But a large number of species have never crossed over to the Island State, owing to Bass Strait forming before they commenced emigration. In the present day the "grinder" rarely gets further south than the Great Dividing Range in Victoria.

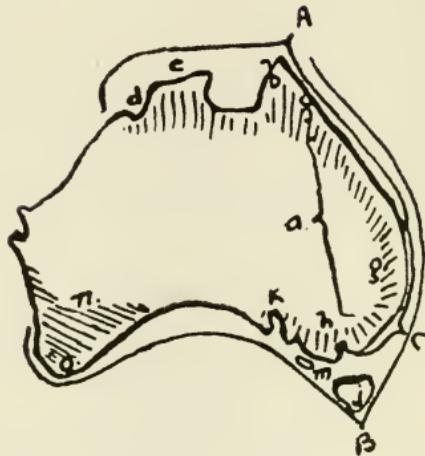
Why is it absent from Central Australia, except for odd pairs in favourable seasons, is not so easily explained.

Locality "b" has the smaller race of "a," while "c" has the paler race, and "d" the western race of "a."

It is on first sight much like the common Black and White Fantail or Shepherd's Companion. A distinguishing difference in the plumage shows out in the white of the whole under surface, including the throat. The nest is built in the higher branches of a tree, while the Shepherd's Companion builds in the lower. The eggs are laid in September on to December.

ROSELLA GROUP OF PARROTS

This group is a part of the broad-tail section of parrots. Map 18 indicates the distribution of its kind over Australia. There is an eastern, western and northern set of rosellas, all of the same construction with different colours in the same colour schemes. They are friendly birds, nesting in the



MAP 23

Distribution of:

- A—a. Red-headed Honey-eater (*Myzomela sanguinolenta*) with races b.c.d.
B—Spine-bill Honey-eater (*Acanthorhynchus*) with races f. j. o.
C—g. h. Bell Honey-eater (*Manorhina melanophrys*).

hollows of the trees close by and feeding on the scale insects and grass seeds of the bush. In dry seasons they are a little harmful to the neighbouring orchards, as fruit eaters. Their habitat is local so that they learn their feeding grounds and change them with the season. Winter will draw a congregation of adjacent families, though not to the extent of truly gregarious birds.

The northern section "c" of map 18 is paler than the southern, which is a natural law in Australia; but it is nor less attractive in its light blue plumage and lemon head. The southern birds "a" are in such great number, and consequently so familiar to the eye, that we do not properly appreciate the beauty of their suits of many colours.

The largest of the group is found along the beautiful Derwent Valley of Tasmania. The first of the group was discovered at Rose Hill near Sydney, from which the twist in the name evolved.

KINGFISHERS (Kookaburra Races)

The Laughing Jackass, or Kookaburra, is more properly termed the Great brown Kingfisher. In the south "a" map 21, it is the largest of the family, and the plainest. In the north a¹, particularly the Bloomfield River, it is the smallest, and with more colour. To use another common name this "bushman's clock" is a very friendly bird all through the day, and believes in being early to bed and early to rise.



MAP 24

Grass Warblers (Cisticolæ):

A—Extra Australian species.

B—Australian races.

b. Grass Warbler (*C. exilis*).

b¹. Northern race of Grass Warbler.

b². Western race of Grass Warbler.

b³. Pallid race of Grass Warbler.

As a utility bird it hangs somewhat in the balance, killing useful lizards and stealing nestling birds. As a set off against this we know that it feeds on young snakes and yabbie crayfish. These latter destroy an infinite amount of fish ova and considerably damage irrigation channels. Its popularity saves it!

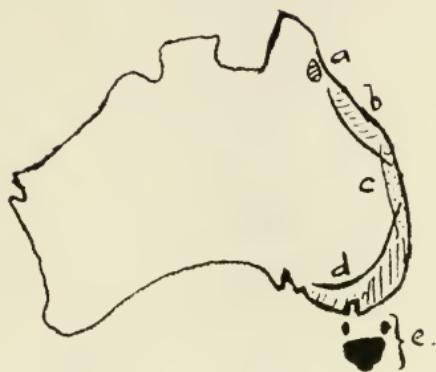
The northern form "b" is found on the Gascoyne River in the west, with the paler race b^2 in the drier area. These northern races are not nearly so musical as the southern. They also differ in their way of nesting, the large termite dwellings of the tropics being bored into. The eggs are pure white. The young in the first few weeks voice their ancestors and learn more fully the lesson of their parents. The following spring they have accomplished the standard of their kind.

How the Kookaburra got into West Australia we do not know, but it certainly came from the south east of the continent as it bears the geographical stamp of that species. Mr. A. J. Campbell considers it was introduced in 1896.

To the great interior it has not followed the Halcyon.

DISTRIBUTION OF THREE LARGE CUCKOOS

In these three we have more than map interest. viz., conspicuous form, colour and habit. Map 22 shows the extent of country over which three

**MAP 25**

The Ground Thrushes (*Oreocincla*):

- c. Australian Ground Thrush (*O. lunulata*).
- a. Northern race.
- b. Russet-tailed race.
- d. Victorian race.
- e. Tasmanian race.

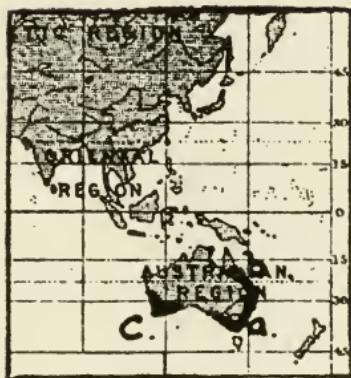
species of large cuckoos wander and fix their abode.

a. Pheasant Coucal: b. Channel Bill: c. Koel. **The Coucal** is the only Australian cuckoo which builds a nest and rears its young: the plumage of such wonderful callow young that the world knew in the adult stage centuries ago. It has long since disapperaed. This truly owned nest is placed by preference in rank grass, and the young are fed on all sorts of things.

The **Channel Bill** is found in the Celebes and very occasionally in Tasmania, so it has a wide range. It also has several lines of migration. The "flood bird" is the largest of our cuckoos with a fondness for laying its eggs in the nests of the Crow and Bell-Magpie.

Floods appear to be a governing factor in their distribution, the natives in certain quarters speaking of it as the flood bird. Although the Channel Bills do not rear their young, they gather them together in preparation for the migration flight, simply saying good bye to crows and magpies for that season.

The Koel, in the male sex, is a metallic black cuckoo. The young in both sexes are black like the male parent, which is most unusual. The hen bird changes from black to brown. Sometimes it is known as the brain fever bird. It is a little trying in the tropical heat of the day to hear nothing but the monotonous call of one animal.



MAP 26

The Coach-whip Birds (*Psophodes*).

- a. Coach-whip Bird (*P. olivaceus*).
- b. Lesser Coach-whip Bird, race of a.
- c. Black-throated Coach-whip Bird (*P. nigrogularis*).

Everything else is apparently in the shelter of the shade.

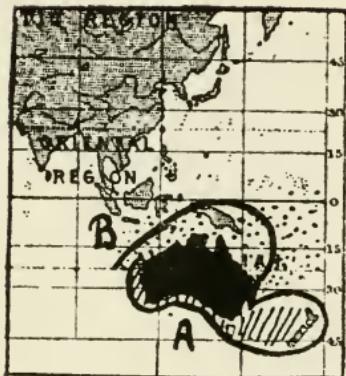
The Wood-Swallow (*Artamus sordidus*), found also in Tasmania where there is no koel, is one of the foster parents to other cuckoos.

DISTRIBUTION OF CERTAIN HONEY-EATERS

- A. Scarlet-headed Honeyeaters.
- B. Spine-bill Honeyeaters.
- C. Bell Honeyeater (Bell Bird).

The honey-eating family (*Meliphagidae*) is a large Australian one noted for its brush tongue and: A for colour, B for form, C for voice (map 23). Coastal honeyeaters live in sand-dune trees bearing sweets-laden flowers. Mostly they live on eucalypt blossoms which supply sweet liquid. Many find insects in the teatree scrub (*Melaleuca*).

- A. The red-headed is made up of two species and several races b.c.d., one of which is confined for the most part to mangrove inlets of the sea. The southerly range is the Buffalo Mts. and Eastern Gippsland.
- B. The Cobbler's Awl is found on the mainland along the eastern side. In Tasmania there is an island race. The western representative between Eyre Peninsula and Cape Leewin has a white eyebrow.



MAP 27

Gannets in Australian Waters.

A—The Australian Gannet (*Sula serrator*).

B—Equatorial Gannets.

Sula leucogaster Brown Gannet.

S. sula Red-legged Gannet.

S. dactylatra Masked Gannet.

C. The Bell Miner is remarkable for its voice, the sweetest notes of tinkling bells, "softer than slumber and sweeter than singing." It is the wet forest bell-bird, while the bell-bird of the dry forests is the Crested Bell-Bird (*Oreoica*). Port Phillip is its further west, and the scrubs of central-eastern Queensland its furthest north. It loves the quiet of the gullies and the damp timbered lowlands.

DISTRIBUTION of the GRASS WARBLERS (*Cisticolae*)

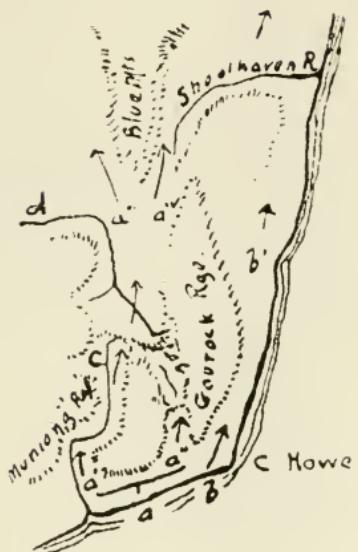
(Plate 1, Fig. 24)

- A. Extra Australian species.
- B. Australian species.

The family is Indian and Australian. It is found all over Australia, but not throughout the Island State, Tasmania. It just touches the northern coast and is found in the island fauna connecting Tasmania and the mainland. Map 24 shows its broad distribution.

As its name implies, it is a grass loving bird and a particularly shy one. Each season of the year it changes its plumage markings, so that it would appear as if there were four species, instead of one with seasonal phases.

The nesting ways of this bird are quite out of the ordinary, the species being a tailor bird in so far as it stitches together a few of the grass strands



MAP 28

Birds of the Eastern Bassian Sub-region pass northward through:—

- a— a' The Valley of the Snowy River.
- a² The Pass leading into the Snowy River Valley.
- b—Passing along the coast up to the Shoalhaven Valley where a⁴ and b join forces.
- a³, a⁴ and b meet again in the Fitzroy Valley about Rockhampton: many do not go so far.

of the nests. This is not a fixed habit as many of the nests are just as usual with birds. The eggs are quite extraordinary, as they are bluish-green with spots of brown. Very few of the Australian birds lay bluish eggs; a negligible quantity.

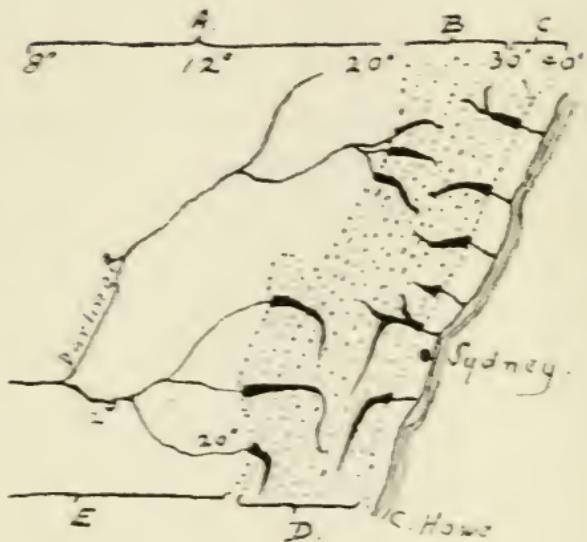
DISTRIBUTION OF THE GROUND THRUSH (*Oreocincla*)

(Plate 1, Fig. 25)

This ground bird is a mountain thrush, more or less confined to liberal rainfall. The bird hunts for its food of snails and worms in the tangle of the ground-vegetation, rarely coming to the openings. Like the English Thrush it is brown and lunated, and the young are just the same. It is quite unusual for ordinary fledglings to have the feather-image of their parents, as most young are not born in the high stage of development of thrushes.

The young are born in the late winter, about the time of the Lyre Bird, and before seven-eighths of other species. Their nest is not always of cradle form, being a weighty though lovely structure on a solid trunk of tree. It may be a musk (*Olearia*), or a tea tree (*Leptospermum*); in Queensland more likely a cedar.

Some naturalists say we have five species of ground thrushes as shown in map 25. It is sure to say, that D is a race of C. D is darker than C,



MAP 29

Relationships and Bathic Migration Routes:—

- A. Lowlands.
- B. Highlands.
- C. Coastal Plain.
- D. Main Routes of Bathic migration.
- E. Rainfall (annual average).

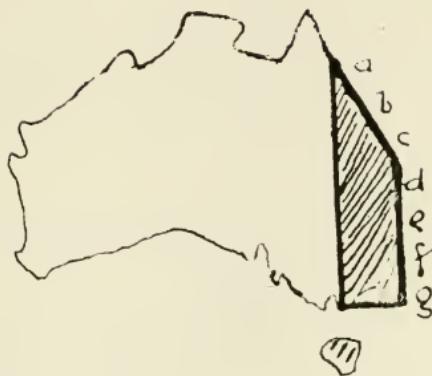
which is generally so with all birds of these areas, while "e" is the darker insular form of the mainland. Island birds incline this way. The whole family is low voiced, to be heard only in the tender hours of the day, in the quiet of the close set scrub. Mt. Lofty is the western limit of range of the species.

DISTRIBUTION OF THE COACH-WHIP BIRDS

In map 26 we have a long drawn distribution of whip birds found within the great belts of high forest trees. The northern form "b" grows larger as it gets south to "a," and takes on a new plumage feature as it goes west, being black on the throat. This we should note is not the customary way of western species, because they have ceased to be eastern. The whip-crack is to be heard in most of the tangled ground scrub. The long series leading to the main notes is made by male and female. They get much joy out of their morning game of down and up the supple-jacks, lasting an hour or more, along a dead bough in the everlasting green.

The National Reserve of the Bunya Mountains we hope will be an eternal sanctuary.

The eggs of this crested whip-bird are of the palest delicate blue green. The eggs of another crested bird the Wedge-bill (*Sphenostoma*), also are of the most delicate pale green. This latter



MAP 30

Highest nesting altitudes in Eastern Australia.

- a. 5,000ft. Spine-billed Honey-eater (*Acanthorhynchus*).
- b. 4,000 ft. Yellow Robins (*Eopsaltria*).
- c. 4,500 ft. Grey Bell-Magpie (*Strepera*).
- d. 5,000 ft. Flame-breasted Robin (*Petroeca*).
- e. 6,000 ft. Shrike Thrushes (*Colluricinclla*).
- f. 7,000 ft. Pipit (*Anthus*).
- g. 3,000 ft. Fire-tailed Finch (*Zonæginthus*).

The Grebe on Lake Titicaca, Sth. Amer. nests at 12,000 ft., and a Humming Bird on Cotopaxi at 16,000 ft.

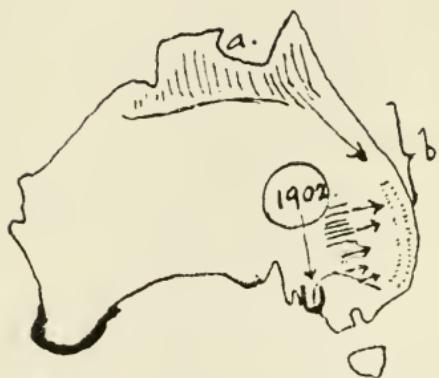
species lives in a thousand miles of parched country parallel to the 1,000 miles of country shown in map 26. Both are conspicuously different to all other birds, and to each other, making the colour of their eggs more than passing interest.

The Coach-whips love the glens far from the haunts of men, and communion is mostly with those dairy maids on the outposts.

GANNETS IN AUSTRALIAN WATERS

- A. The Australian Gannet
- B. Equatorial Gannets

The very similar species in the European waters is known as the Solan Goose, though it has no goose like leading characters. Both are web-footed. The gannets fish in many seas and we have four species in three oceans. Map 27 shows one kind in the southern ocean, and three on the western, northern and eastern shores. In winter they enter the bays to follow the shoals of fish, which they capture by diving perpendicularly through the air from a great height. The stronghold of the southern bird A is Bass Strait, while its most southerly resting place is on the Mewstone Rock south of Tasmania. This rock is the extreme southern end of the Australian land shelf, and all that is left of it. The largest of its rookeries is on the Flinders Group, where 2,500 birds may be seen nesting in October. Two eggs of beautiful blue entirely



MAP 31
Sporadic Migrants.

- a. Usual habitat.
- b. Extended area.

Arrow denotes exit from drought area.

covered with lime are laid, one being incubated by the male, the other by the female, and the young of those eggs are cared for by each of the parents.

The young are naked and of a lead colour. When feathered they are conspicuously mottled in the way of their ancestors and make a strong contrast to the white of the parents. A second brood is hatched out in February.

The Masked Gannet breeds on Norfolk Island, and feeds on flying fish. The serrated beak, which is a recently acquired character, holds well. The Red-legged Gannet nests on the Great Barrier Reef. The Brown Gannet lays its eggs on Booby Island in Torres Strait.

It is a most trustful and affectionate family of sea birds.

NEW SOUTH WALES

Areas 3, 4, 7³, 7⁴

Spring witnesses the inrush of a million birds into New South Wales from Queensland, and the passing south of a million others into Victoria. It also gives an impulse to the birds at the mountain feet to go up its valleys to the heights to nest.

The two lines of immigration from the north are Eyrean of the plains and Torressian along the mountains.

In an abnormal season there is an influx of vast



MAP 32

Permanent Birds, e.g.—

- a. Albert Lyre Bird.
- b. The Lyre Bird (*Menura superba*).
- c. Victoria Lyre Bird.
- a. b. c. Magpie Lark (*Grallina*).

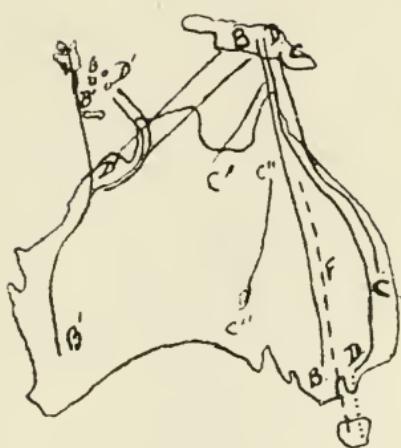
myriads of feathered life from the dry west into the eastern hills. That is the spasmodic west-east irruption. This is in contradistinction to the regular annual bathic ascent to the higher levels of the rivers and the plateaus. Autumn sees the return of the birds from the Bassian or Victorian south, into the plains of the Riverina. The cold of the mountain heights is driving down the birds to the lower levels again.

New South Wales is visited annually by migratory birds from Papua, which come to nest, as well as by species from Siberia which come to winter, but not to nest. From the south, the coast of New South Wales is visited by vast numbers of sea birds which pass northward in the winter, on their way to the "far east" (Chosan).

The rich western half of New South Wales, being subject to drought, demands a sweeping exodus of birds for a year or two together. The compensating balance is a flood, when hundreds of millions flock back to what is now one of the richest centres in the world; with an abundance of food and water for the birds.

There is also an annual migration from the north which would be diverted in this time of drought, or the birds would pass through into Victoria and eat up everything, thus destroying the balance.

The distribution of the birds of New South Wales is more variable than with any other portion of the continent of Australia. These are the repre-



MAP 38

Migrating birds with approximate lines of flight.

sentatives of the three great zoological sub-regions of Australia proper, as shown in Map 29.

Then there is the annual migration of these species from any one of these sub-regions into a second one, to the extent that birds of the Bassian sub-region, in the northern portion, pass northward to winter in northern New South Wales (Eyrean sub-region). This is while they pass from the southern Eyrean (N.S.W.) into the northern Eyrean (Queensland) to winter.

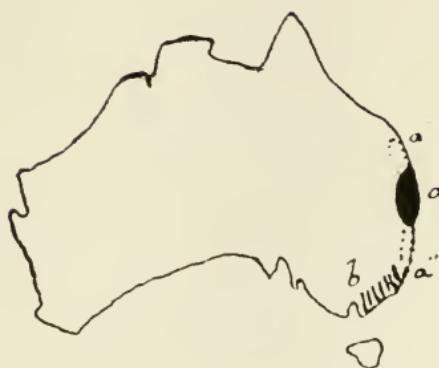
A third horizon of interest is the Bathic (map 29, 30), the passing of lowland birds into the area of 5,000 ft. to 7,000 ft., to nest in summer snow storms. Apart from this we see from time to time —two to seven years—sporadic migration on a large scale.

And we have the birds purely local in the dry Eyrean, as well as those local in the moist Bassian forests.

It may be said in the matter of extension of distribution that a species of bird has:—

- A—A portion of the continent in which to winter
- B—A portion of the continent in which to summer.
- C—A portion of the continent in which to summer and to winter (local).

It is very much dependent on the season and local food supply whether or not a species will extend its area for that season, or a cycle of years. Such a bird as the Magpie, coming under neither A nor B is constant to its stretch of country the



MAP 34

a. Irregular Migrant.
b. Fixed Location.

- a Regent Bird (*Sericulus*).
a¹ Regent Bird Northern Extention.
a² Regent Bird Southern Extention.
b Pilot Bird (*Pycnoptilus*).

whole twelve months and will die through shortage of grubs rather than shift to another part of the country.

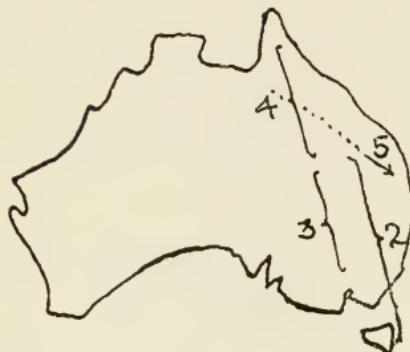
The Regent Bird e.g., generally a fixed inhabitant of the country between the Tweed and Hawkesbury Rivers, will once in fifty years make its way north to the Mackenzie River, or south to Bega. It is abnormal distribution, and must not be set down to regular occupancy of larger areas.

SPORADIC MIGRATION

(Plate 2, Fig. 54)

This form of migration is due mostly to reduction of food through drought. Rats and mice will leave Queensland for the plains of northern Victoria, and the Grass Owl will follow in thousands, though not in flocks. Even so, they are the silent birds of the night, born for the purpose of checking wasteful and cancerous mice.

For similar reasons, in relation to insects, the Oriental Cuckoo will leave its usual haunts in northern Queensland for New South Wales (Map 31). The great interior droughts of 1902, 1907 and 1919 have been the cause of tremendous eruptions. On 12/6/02 thousands of ibises were seen flying south to the Murray River Lakes (D. Le Souef). In 1907 thousands of Wood Swallows (*Artamus personatus* and *A. superciliosus*) left the interior for eastern New South Wales (H. L. White), i.e.



MAP 35

Internal Migration and Eastern Distribution:
e.g. Chats (*Ephthianura*).

2. Approximate North and South migration limits of the White-fronted Chat (*E. albifrons*).
3. Summer home of Tricoloured—and Orange-fronted Chats (*E. tricolor* and *E. aurifrons*).
4. Winter home of Tricoloured—and Orange-fronted Chats.
5. Changed line of migration in drought season.

an Eyrean irruption into Northern Bassian. In 1918-19 thousands of Warbling Grass Parrots (*Melopsittacus undulatus*) left the plains in the drought for the hills, and hundreds of White Egrets (*Herodius timoriensis*) left the inland creeks for the coast (Edwards, Bega). The Painted Finch (*Emblema picta*) left the interior and found its way in large quantity to the Parramatta Basin.

The general trend of drought movements in New South Wales is as follows:—

A. To the Darling River; Upper reaches.

a¹ South from Queensland.

1. Red-winged Parrot (*A. erythrops*).
2. Flock Pigeon (*H. histrionica*).

a² From immediate drought area: White-Eye (*Zosterops dorsalis*).

B. To all Downs e.g. Tricoloured chat.

C. From the West into the great Coastal Range:
e.g.

c¹ Talbragar District, Red Wattle Bird *A. carunculata* in vast numbers (T. P. Austin).

c² Upper Hunter River District.

Red-backed Parrot (*P. haematonotus*).

Red-shouldered Grass Parrot (*N. pulchella*).

Cockatoo Parrakeet (*C. novæ hollandiæ*).

Emu viii., 1, p. 16. S.W. Jackson



MAP 36

Distribution of:—

1. A species and its races: A. North of the Blue Mountains.
B. South of the Blue Mountains.
2. A species without races b¹ b² Fire-tailed Finch (*Zonæginthus*).

A—Rufous Shrike Thrush (*Colluricincla rufigaster*).

- a¹ Pale inland race (fawn coloured).
- a² Small northern race.
- a³ Minute race.

B—Crescent Honey-eater (*Meliornis pyrrhoptera*).

- b¹ Southern race.
- b² Tasmanian race.
- b³ Kangaroo Island race.

- D. From northern New South Wales in December drought into central Queensland. Tens of thousands of Native Hens (*M. ventralis*) erupt and eat out the tender grass of all dam-frontages, leaving quietly in a mass a few months later.

PERMANENT SPECIES

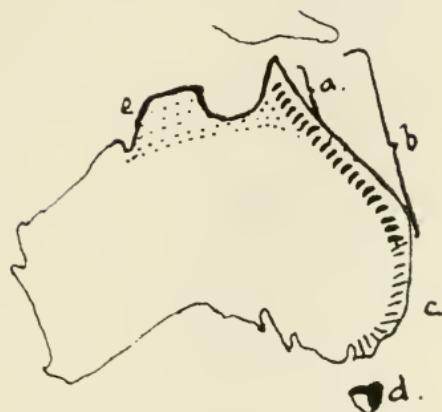
(Plate 2, Fig. 74)

Certain birds, e.g., the Lyre Bird, are thoroughly fixed to their place of birth. Others, as the Bell-Bird, are slightly nomadic when the food gives out, while the Magpie-Lark will temporarily move beyond its close range.

There are forests in which many species may be seen at any time of the year. Take for example the Macpherson Range in the north, and we may find at any time the Scrub Wren (*Atrichornis*), Olive Whistler (*P. olivaceus*), and Pilot Bird (*Pycnoptilus*.) In the south at Bega we will at all times of the year see the Black and White Fantail, the White-backed Magpie and the Noisy Miner.

By dividing the forests of the Coast Range into three parts we find three species of Lyre Birds, each permanently fixed in its area.

It is rather wonderful that thousands of migratory birds pass along and beyond these forests twice a year.



MAP 37

Coastal Distribution.

e.g. Topknot Pigeon (*Lopholaimus*).

- a. Northern race.
- b. Stronghold of species.
- c. Extension of range; numerically weak.
- d. Sporadic distribution.
- e. Normal western range of the species.

MIGRATION THROUGH THE AUSTRALIAN REGION (North—South)

(Plate 1, Fig. 6: Plate 2, Fig. 61)

The wonderful birds that come in the spring, or pass through to the south, appeal to us. They nest on the Polar tundra in June—July in the greatest swamps of the world, and feed in our lagoons during October—March.

Other series nest in Manchuria and Japan, coming south in much the same way and time. The arrivals are fairly regular:—

August-September: Snipe (*Gallinago australis*).

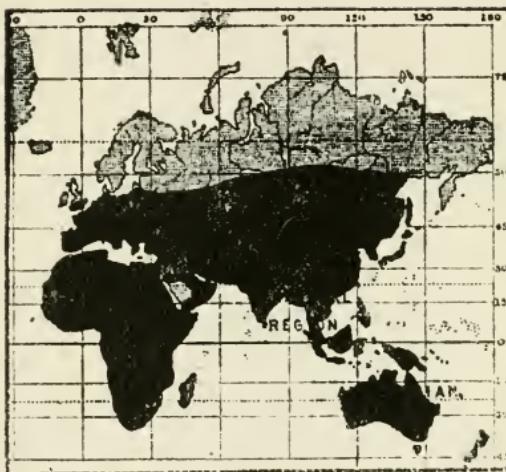
October: Little Stint (*Limonites ruficollis*).

Tasmania is the highest southern latitude, and the Stint is found in the extreme southern portion. In map 33 several lines of migration are shown.

PARTIAL MIGRANTS

(Plate 1, Fig. 34)

There are many examples of birds which travel short distances. Some are bathic and others coastal. In the first case we have the Pied Robin (*Petroica bicolor*), which ascends from the valleys to Monara heights, and nests in February. In map 34 we have an example less common, viz., the Regent Bower Bird (*Sericulus*). The Clarence River district is its stronghold, while in a season like that of 1919 it may be found as far south as



MAP 38

Stationary bird; not migratory.

e.g. Tippet Grebe.

Bega, and as far north as the Mackenzie River. Before civilisation changed the face of the earth it was regularly found about Port Jackson.

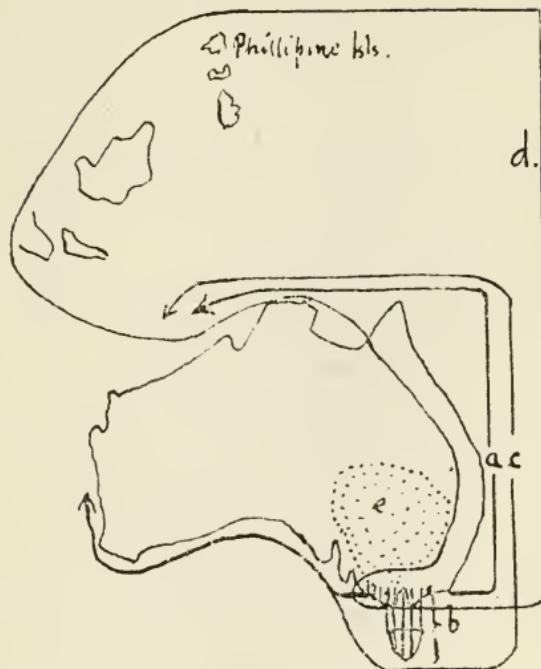
Bower Birds are amongst the most wonderful animals of the world by reason of their playgrounds, their remarkable colours, and the picturesque marking of their eggs.

INTERNAL MIGRATION AND DISTRIBUTION

(Plate 1, Fig. 7: Plate 3, Fig. 93: Plate 2, Fig. 35)

Migration and distribution are very different and equally variable. With our Bee-eaters, Rollers, Kingfishers and Cuckoos, the migration covers a distance of two thousand miles, and is within the Commonwealth. The sub-regional or State migration is the real internal—and much shorter flight. Both return to the same place they nested in the previous year, the strongest going further south. They are those born in the higher latitudes and are more robust. Halcyon, the wood kingfisher, arrives in Victoria generally in October. Millions of birds pass between Queensland and Victoria in Spring and Autumn.

The exodus from New South Wales Eyrean to Queensland Eyrean is an irregular internal migration due to drought. The Bustard will miss its usual nesting season in July—August in its own territory of New South Wales and lay in January



MAP 39

Quail.

- a. Brown Quail (*Synoicus australis*)
Little Quail (*Turnix velox*)
and other turnices. } Over Australia.
- b. Tasmanian Brown Quail.
- c. Stubble Quail (*Coturnix pectoralis*) } Over Australia
Painted Quail (*Turnix varia*) } and Tasmania.
- c' Eruption of c from Central Australia in drought.
- d. King Quail (*Excalfactoria chinensis*).
- e. Plain Wanderer (*Pedionomus*).

—March in the north. The majority of internal species in extreme circumstances will make eastwards to the mountains, or to the tributaries of the great rivers. If e.g. the Yellow-tufted Honey-eater (*Ptilotis melanops*) refuses to go, the starvation roll is heavy.

The White-fronted Chat (*E. albifrons*) may be a stationary or a partial migrant. In time of drought a portion of the birds in their northern limit will, before facing the south, deflect their course to the east by south (e.g. 5 Map 35), and summer in large numbers just north of the Blue Mountains. They have been known to do this in June, and nest in thousands. A flock of 250 will arrive in the south-west of the State from southern Victoria.

Map 35 shows the range of the various species of chats.

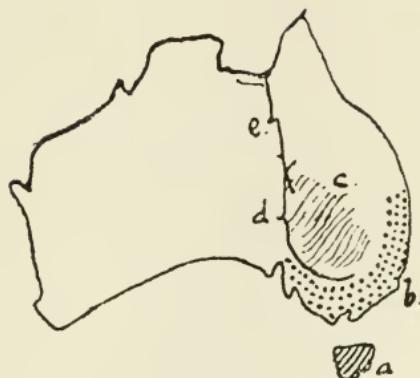
DISTRIBUTION of

1. A species and its races.
2. A species without races.

1. Races shown in Map 36 may be:—

- A. Those found north of the Blue Mountains
- B. Those found south of the Blue Mountains

A good example of A is the Shrike Thrush (*C. rufigaster*), which grows less in size the further north it lives. An example of B is the Crescent Honeyeater (*L. australasiana*).



MAP 40

Eastern Magpies.

- a. b. c. White-backed Section.
- d. e. Black-backed Section.
 - a. Small race of b.
 - b. Large race of a.
 - c. Intermediate between a b.
 - d. The larger race.
 - e. The smaller and brighter race.

2. The north and the south have their species without sub-species:—

2¹ Masked Owl a¹ a² a³

2² Fire-tail Finch b¹ b²

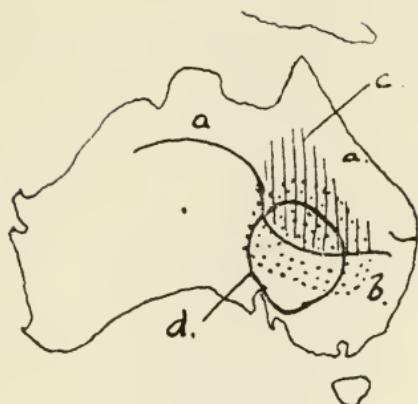
The owl keeps to the long stretches of grass-land; this species of finch to the forests of the coast. They both have separate utility duties of high economic value. Finches are of the type born helpless, and with brilliant mouth parts to serve as a guide to the parent when placing a grub in the mouth. The nest is dark within.

COASTAL DISTRIBUTION AND COASTAL MIGRATION

(Plate 3, Fig. 85)

In Map 1 we see that the coastal distribution of New South Wales birds is divided in the vicinity of Port Hacking. Map 37 gives the Top-Knot Pigeon as an example of a species with a continuous distribution over the two coastal sub-regions a, b, Eastern Torressian, c, d, Eastern Bassian. So far as d is concerned it is simply sporadic from c.

A second direction of expansion is shown in the dotted lines from "a" of map 37. This is the case with the Pheasant Pigeon, and these two species help to show the two principal lines of expansion of the Australian birds from York Peninsula. In the northern portion of this sub-regional division



MAP 41

Inland Distribution: Seed Eating Parrots and Finches.

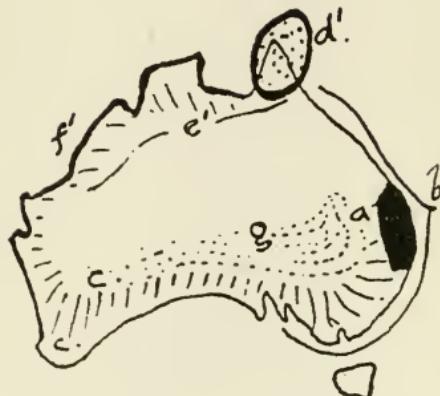
- a. Banded Finch (*Stizoptera bichenovii*).
- b. Plum-head Finch (*Aidemosyne modesta*).
- c. Black-throated Grass Finch (*Poephila cincta*).
- d. Pink-bellied Grass Parrot (*Neophema bourkii*).

we find small forms of the southern species: e.g.
Sacred Kingfisher (*Halcyon sanctus*).
Red-browed Finch (*Aegintha temporalis*).
Blue Wren (*Malurus cyanochlamys*).

There is a considerable over-lapping of species between Port Hacking and the Clarence River District. It is again clear that the further north one gets from this line the smaller the birds are, and the further south from it, the larger the same species are.

Coastal migration concerns the wonderful highways of eastern birds passing from the State of New South Wales into the State of Victoria. This again is divided into the Coastal Plain, and into the Valley of the Hawkesbury River between Lakes Bathurst and George, and up the higher waters of the Murrumbidgee, and across the watershed into the Snowy River.

The birds unequally divide in the southern Monara district, the smaller quantity ascending over the pass into the low land country of Eastern Croagingolong. Many coming south meet the Shoalhaven River and ascend it. They then meet the Gourock Range, keeping on the eastern skirt, e.g. the White-browed Wood-Swallow (*Artamus superciliosus*) arriving in October.



MAP 42

Inland Distribution: Tree Runners (*Neositta*)

Brown spot (Recognition mark).

- a. White-headed Tree-runner: S. Q'land and N.S.W.
- b. Orange-winged Tree-runner: Q'land, N.S.W., Vic., S.A.
- c. Black-headed Tree-runner.

White spot.

- d'. Pied Tree-runner.
- e'. Striated Tree-runner.
- f'. White-winged Tree-runner.
- ½ Brown, ½ White.
- g. Slender-billed Tree-runner.

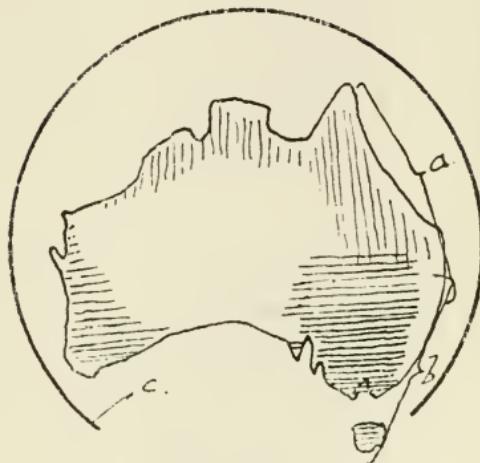
BROAD DISTRIBUTION

The Tippet Grebe is found in Europe and Asia, and it is the same species as found in Australia, Tasmania and New Zealand (Map 38).

It is rather wonderful that such a particularly poor flier should have got across such isolated parts.

The head display is seasonal and both sexes enjoy it, following up the marriage custom of long ago. After this follows the nesting, and the birds hold their necks upright to present the appearance of a stick in the water. If a flood occurs the nest is built upwards and the eggs raised. If the nest cannot be quickly built up the eggs fail. When the flood disappears the addition to the nest is reduced and flattened out. The young swim immediately on leaving the eggs. The striped plumage shows the ancestral colour scheme.

A smaller grebe, the Black-throated species, is found as far off the mainland as New Caledonia and Java. It has lobed feet and travels in the water freely. The nests are on a swamp and the birds while sitting on the eggs almost cover themselves with the water-weeds of the floating nest. During the day the sun does the work of incubating and the birds at night. I have seen as many as seventeen nests on one small weedy swamp, in all of which the eggs were hidden by a rough roof of water weeds.



MAP 43

Distribution of:—

River Ducks.

Spiny-tailed Ducks.

Sea Duck.

Shieldrakes.

a. White-headed Shieldrake (Burdekin Duck) (Tadorna).

b. Chestnut-breasted Shieldrake (Mountain Duck (Casarca).

Blue-billed Duck (Erismatura) } Spine-tailed
Musk Duck (Biziura) } Ducks.

c. Eight species of river ducks all over Australia.

One species of sea duck (Nyroca).

DISTRIBUTION OF QUAIL

(Plate 3, Fig. 93)

The true Quail of the Commonwealth is the Stubble Quail (*Coturnix pectoralis*). It is a grass loving bird, and is local in its habit as long as the food supply is present. Should a plague of mice or caterpillars come along they get the seed and the quail moves away. Thus we get an ever-changing position. If a Central Australian drought rages the birds move southward in a great mass to the Murray River swamps, c¹.

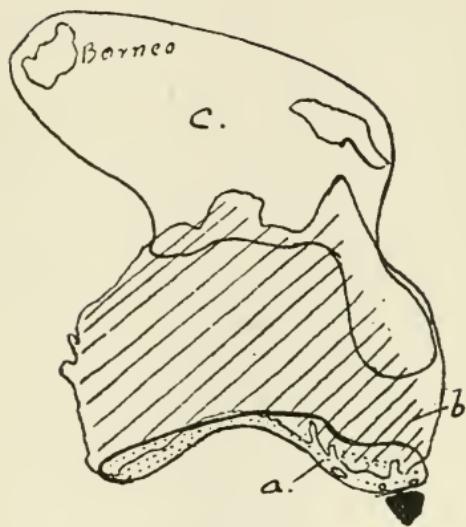
Other quails are the Painted and Brown. The Brown species "a," (map 39) is variable in different swamps, and is the swiftest flier of the quails.

The island form of "a" is b, and it is a paler bird. Because it is so constant in its colour it is thought to be a species.

The King Quail "d," map 39, has more colour than our other quails and it is more broadly distributed. It is said to be the smallest known game bird, and keeps to swampy ground.

The Painted Quail "c" has no hind toe. The call is a once repeated coo before rising from the heath in a wavy flight.

The Plain Wanderer with a spotted ring upon its neck keeps to the area "e," occasionally nesting as far south as the plains just west of Melbourne.



MAP 44

Distribution of the Geese and Swan.

- a. Cape Barren Goose (*Cereopsis*).
- b. Pied Goose (*Anseranas*).
Maned Goose (*Chenonetta*).
Black Swan (*Chenopis*).
- c. Pigmy Geese (*Nettapus*).

The eggs are pointed, pear-shaped, and laid upon the bare ground. The male does all the hatching, a most unusual procedure. As a feeble flier it almost prefers to let itself be caught.

DISTRIBUTION OF EASTERN MAGPIES (*Gymnorhina*)

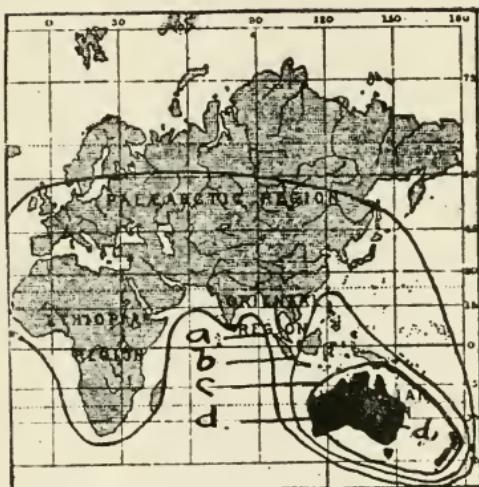
- a. b. c. White-backed section of Eastern Magpies.
- d. e. Black-backed section of Eastern Magpies.

Magpies are the popular birds of our people with one dissenting voice. That voice belongs to the man who grows grain and who accuses the bird of eating the seed. Many small grubs about that seed are the principal attraction for the bird.

Queensland "e," map 40, has its magpie, black-backed, with one record of variation. (Cape York Peninsula, H. L. White).

Both backs are found at Port Augusta, S.A., the Wakool River and Moree, N.S.W. At Lithgow, Bombala and Cooma, the White-back is the only one so far reported. At present it seems as if the White-back is the common bird in the coast mountains, the Black-back far north and inland, and the variable bird between. It is dimorphic throughout most of Australia. In Tasmania the magpie is a small White-back, instead of following the general law of being larger.

The parents are devoted to their young during the first ten months, after which they get notice



MAP 45

Australian Cormorants.

- a. Black Cormorant (*Phalacrocorax carbo*).
- b. Little Black Cormorant (*P. ater* = *sulcirostris*).
- c. Little Pied Cormorant (*M. melanoleucus*).
- d. Pied Cormorant (*P. hypoleucus*).

to quit the nesting ground. An ejectment is often necessary and occasionally a young bird lies down rather than be hustled away by wing and claw. If it is firm in its refusal to budge, the parents reconsider the matter and finally tolerate it during the following nesting season.

The position is that the parents need all the grubs for the coming brood, and prefer that their selection be left free of mouths able to feed just as well abroad.

It is really sentiment on the part of the young. If a drought season does set in the weakling young in the nests certainly die, and many of the strong, as the food is slender.

INLAND DISTRIBUTION

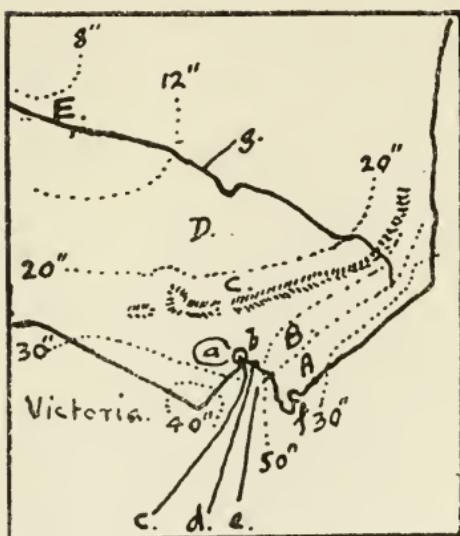
Grass-seed eaters.

- a. Parrots.
- b. Finches.

Looking at map 41 it would appear as if the grass areas of Australia were correctly defined by those parrots and finches which feed on grass seed. If millions of small birds have been feeding on grass seeds for centuries, it is natural they should know of the good pastoral land.

Burke's Parrot "d" is the rarest of this group, and the Blue-winged species the most common. They make an elegant and shy genus which nests in logs.

AUSTRALIAN BIRD MAPS



MAP 46

A—Bassian Birds; one line of migration between N.S.W. and Tas., along the 30 inch rainfall belt.

B—Mountain species, mostly non-migratory.

C—Hill races of species B., Junction of Eyrean and Bassian species.

D—Inland races of B.

E—Desert races of A. } Eyrean sub-region.

a. Isolated area with plain birds (20 in. rainfall).

b. Western range of several genera of B.

c. Barrier against dispersal of certain species of b.

d. Home of estuarine birds.

e. Ocean birds.

f. The longest continuous nesting line of fresh-water birds in Australia.

g. Shore birds.

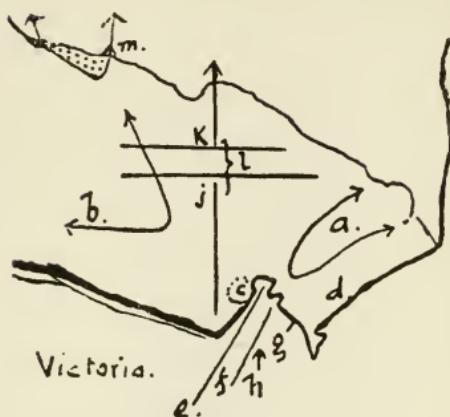
The Finches are a wonderful family. One (1) of them will live only in the cooler forests, another (2) only on the hot dry plains. A species (3) may be modest in plumage, another (4) extremely beautiful. When young (5) they may have no colour and when adult (5) a splendid splash. Then there is the distinctly spotted bird (6) as well as the clearly defined broad pattern (7).

They are friendly birds, building near the dwellings of man and beast, even occupying the lower flat of a hawk's nest. The nests are bulky, and disorderly, considering the family is so æsthetic in its dress.

- | | |
|--------------------------|-------------------------|
| 1. Red-eared Finch. | 5. Red-browed Finch. |
| 2. Chestnut-eared Finch. | 6. Spotted-sided Finch. |
| 3. Plum-head Finch. | 7. Fire-tailed Finch. |
| 4. Crimson Finch. | |

The eggs are numerous and white. Two species are faintly tinged with blue. In Africa the true finches have pale-bluish eggs.

The Gouldian Finch of Northern Australia is the most beautiful of all grass-seed feeders, and one of the most finely-coloured of all known birds. The colour scheme is variable under two heads, as some young will have scarlet heads while others in the same nest will have solid black heads. Dichromatic is the term to apply.



MAP 47

- a. Lyre Bird; Pilot Bird; Sooty Owl; Coach-whip Bird; Bell Bird; Helmeted Honey-eater.
- b. Mallee Fowl; Grass Wren; Wedge-bill; Scrub Robin; Red-capped Robin; White-face; Grey Jumper.
- c. Plain Wanderer; Plain Plover; Bustard; Australian Crane (most southerly nesting ground; now disappearing).
- d. Lowland species—Emu Wrens and Field Wrens.
- e. Bay Birds—Silver and Pacific Gulls and Penguin.
- f. Estuarine birds—Local and Migratory.
- g. Permanent Shore birds (Oyster catchers and Red-capped Dottrel).
- h. Albatrosses and other petrels.
- j. White-backed Magpie (predominant).
- k. Black-backed Magpie (predominant).
- l. Intermediate j—k (predominant).
- m. Pallid race of Bronzewing Pigeon (Phaps chalcoptera).

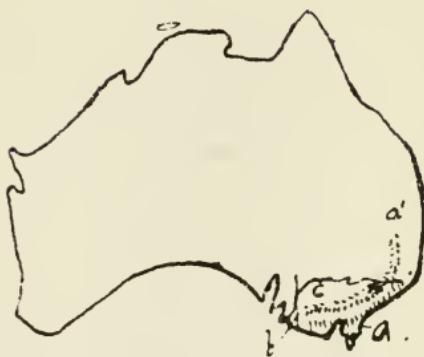
INLAND DISTRIBUTION: TREE RUNNERS (*Neositta*)

- Recognition mark: 1. Brown spot.
2. White spot.
3. Combined spots.

Tree runners travel up the stems of trees, which is the reverse of the Tree creepers. The needle like beaks have an upward curve, being most unusual. They have a love of the beautiful in nest building and enemies cannot readily detect the camouflage in their surroundings. The body-marks make the fourth interesting point in their life history. The species of the southern section of Australia has the brown wing-spot, the white speculum being in that of the northern section. The central section of the continent has the connecting link, half of each speculum. This is interesting as a general classification in the distribution of colour. There is another type of classification. (G. M. Matthews, 1912 list, p. 379).

This genus is the Australian representation of the European Nut-hatches.

The family relationships are of the most pleasant kind, as e.g. birds not nesting. If the mate of a pair about to lay eggs is killed, the hen will lay in another bird's nest, and all will take turns in sitting on the eggs, and hatching out in the usual time.



MAP 48

- a. Species a shade darker than those of a'.
- b. Western races of "a."
- c. Tendency to paler colouration than "a."

DISTRIBUTION OF DUCKS

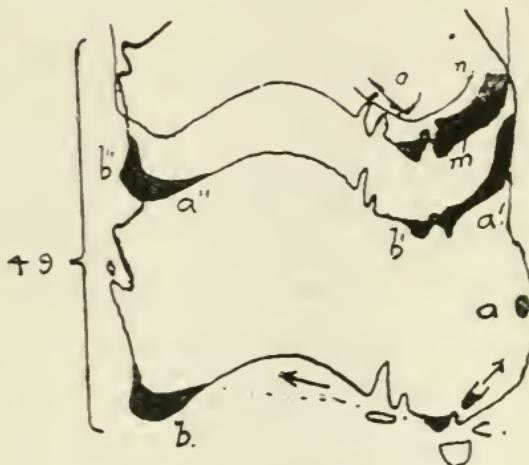
1. River Ducks.
2. Spiny-tailed Ducks.
3. Sea Duck.
4. Shield Ducks.

The two ducks commonly known as the Burdekin Duck and the Mountain Duck appear to have divided Australia between them, leaving out the central portion which does not appeal to them, except in rainy seasons. These two are the two Shielddrakes of Australia (map 43, a b).

The Musk Duck is the best known of the Spiny-tailed section. It is known a mile away, by the odour coming with the breeze, and it has a remarkable air sac for calling. Solitary is its habit and swamp loving, it is rarely seen to fly from lagoon to lagoon. It prefers to walk across country from hole to hole. To escape from enemies it would rather dive. It does fly low and rapid, and occasionally high across long distances. The general habit is to swim and to stay about the nest and food supply.

The Hard-head or White-eyed Duck is the only sea duck we have, being found well over Australia, New Guinea and New Zealand.

There are many species of river ducks, among them being the Pink-eared Duck, the Freckled Duck, the Black Duck, Teal and Whistling Ducks,



MAPS 49, 50, 51

Discontinuous Distribution.

- a. Noisy Scrub Bird (*Atrichornis*).
- b. Rufous Scrub Bird.
- c. Connecting link (now broken).
- a'. Bristle Bird (*Sphenura*).
- b'. Rufous Bristle Bird.
- a² b². The Western races of a' b'.

Relative Distribution.

- m. Yellow Robin (*Eopsaltria*).
- n. Red-capped Robin (*Petroica goodenovii*).
- o. Scrub Robin (*Drymaeus*).

and the Blue-wing, which is the most beautiful and wildest of the family. Young ducks are precocious, hatching out with effective muscles.

DISTRIBUTION OF GEESE AND SWAN

Goose Teal.

Island Goose.

Swan.

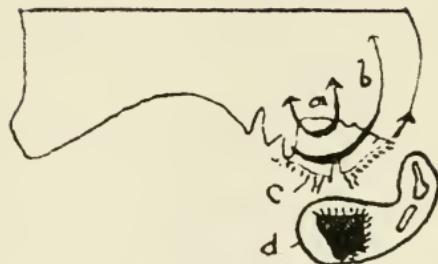
The Goose Teal are made up of two species, and are confined to the northern half of Australia (map 44, c). They are the Pigmy Geese, and are remarkable for the diminutive size, smaller than teal.

In the breadth of southern Australia there is a relic of an ancient fauna, the Cape Barren Goose. The closest relation is the giant fossil goose of New Zealand (a). It is the island goose, scarcely touching the mainland except through force of bad weather.

The Furneaux Group in the east and the Recherche Archipelago in the west are good breeding grounds.

The birds do not nest till they are two years old, and an old bird does not mate with a young one. Should the male be killed the hen flies to another flock, if the female, the male bird will call a new mate from the nearest flock. It feeds largely on grass.

A more widely distributed bird is the Pied Goose, with only half webbed feet. An equally well dis-



MAP 52

Dottrels.

- a. Far interior: Red-kneed Dottrel (*Erythrogonyx*).
- b. Hinterlands: Black-fronted Dottrel (*Charadrius melanops*).
- c. Coastal: Hooded Dottrel (*C. cucullatus*).
- d. Double-banded Dottrel (*C. bicinctus*).
- a. b. c. d. Red-capped Dottrel (*C. ruficapillus*).

tributed one is the Maned Goose (Wood Duck), map 44, b. It appears to be a duck with a miniature goose-bill.

The Black Swan is an elegant and popular bird, probably the oldest known Australian bird on record.

The young are plain grey. If a nesting swamp dries completely, the young are marched overland to another marsh, in the sight of their parents all the time. In Queensland the swan breeds three times in a year, and the first brood of young is driven away before the parents settle down to the care of the second. More serious trouble for the young is found in the number of Golden Beaver-Rats which destroy them.

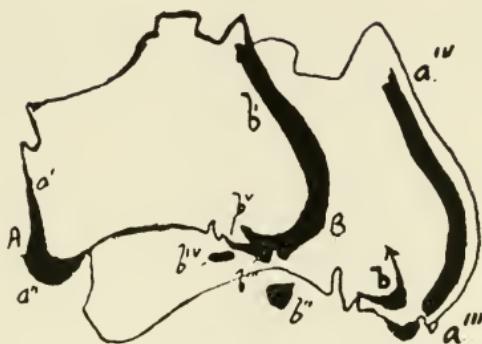
CORMORANTS

(Plate 2, Fig. 45)

1. Australasian.
2. Extra Australian.

The family is a very uniform one, variable only in plumage colour. This is most marked in the disposition of the black and white, and minor pigment colours of the bare skin about the head.

Upon examination of the hard tissues of the family, it is found to be closely related to the Gannets, Tropic Birds and Frigate Birds; all wonderful things in feathers.



MAP 53

Parrots.

a. Highland—a³. King Lory.
a⁴. Variety of a³.

b. Lowland—Mallee Parrots.

Spine-bill Honey-eaters (*Acanthorhynchus*).

A—Western Spine-bills (with white eyebrow) races
a¹ a².

B—Eastern Spine-bills (without white eyebrow)
races b¹ b⁵.

b¹. Cape York race.

b². Tasmanian race.

b³. Victorian race.

b⁴. Kangaroo Island race.

b⁵. Mount Lofty race.

Map 45 shows the distribution of c and d, the purely Australian species.

"A" is the bird of utility value; Manchurians turning it to account as a bread winner for the human family. It certainly is a clever fisher in the rivers, trained to use a boat as vantage ground. Fishing in this way is a common practice along the tributaries of the Amur River, across which Australian migratory birds annually pass.

In the southern hemisphere it is most numerous in Tasmania, getting less in quantity as the Equator is approached.

Although a greedy eater of fish it is a large consumer of the enemies of fish. On isolated islands away from the haunts of man I have found the cormorant a fearless bird, while in its nesting colonies.

"a" is the largest, "c" the smallest, "d" the most common of the Australian species.



MAP 53a.

Owls.

- a. Highland Owl (*Tyto tenebricosa*) Sooty or Black Owl.
 - a¹. Victorian race of "a."
 - a². Northern race of "a."
- b. Lowland Owl (*T. longimembris*) Long-legged White or Grass Owl.
 - b¹. Farthest south, only in sporadic migration.

VICTORIA

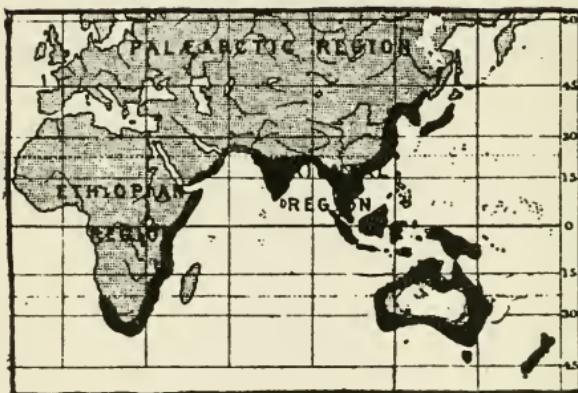
Areas 4—7⁴.

A GREAT JUNCTION

In this chapter reference is made to the southern nesting ground of countless birds. We also find here the permanent stations of birds that have a northern origin, as well as others with an eastern one. It is the great southern junction of Eyrean and Bassian species.

Map 46 shows several zones of bird life and the influence of a mountain chain on a given migration course.

It has kept stationary birds divided, continuing to make new species on both sides. Within a gap of the mountain range we have a great bay (e) and an ancient sunken river mouth (c). These have provided feeding grounds for estuarine and coastal birds. On the south side of the Otway Forest there is a 40 inch rainfall, on the north 20 inches. It has resulted in two types of birds, one loving the wet, the other the dry. This portion of Victoria is a remarkably interesting centre of animal life.



MAP 54

Example of an extensive littoral distribution:—
White-eyes (*Zosterops*).

CHARACTERISTIC BIRDS OF THE VICTORIAN AREAS

(Plate 1, Fig. 9; Plate 2, Figs. 47, 92)

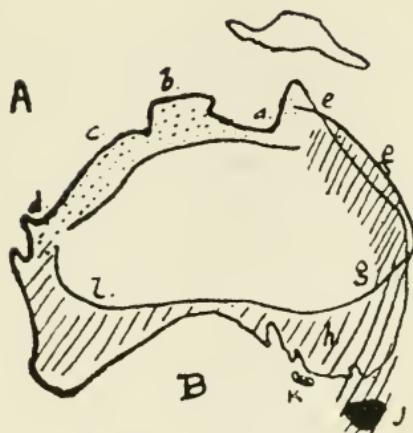
1. Estuarine and Coastal.
2. Moist-cold country.
3. Dry country; timbered.
4. Dry country; open, grassed.

There are in these areas four distinct parallel lines of feathered life, map 47.

The result of incoming shoals of fish is the visiting flocks of web-footed birds. Some are direct fish feeders, as the Terns; others, as the gulls, are scavengers. An immigration of jelly fish (cephalopods) draws in their train the smaller albatrosses. When the estuaries have irregular visits of great shoals of herrings and sprats, quite a number of extraordinary birds pay visit.

The coastal birds we expect by special circumstances to have characters in common, and different from those of other zones. The cold moist country between Cape Otway and Cape Howe is largely tenanted with hill birds differing from all other known birds. A list is given in the text to map 47, highland (a), lowland (d).

The dry forest country (d) contains groups absent from (a), and may be called the Mallee group. The Goulburn Valley is a buffer area.



MAP 55.

A—Golden White-eye and its races in Australia, a—d.

B—Grey White-eye and its races in Australia, e—l.

THE EFFECT OF THE DIVIDING RANGE

As we come south from the warm moist air of the Hawkesbury River in New South Wales, we may observe that the colour of all the birds of any any one species is growing darker (map 48, a). That is the climatic effect on the plumage. Having followed this change as far as Port Phillip, and continuing westward, we less readily see a second change, b. It is the western drier light air influence. The grass and the trees have all accepted the changed weather conditions, and taken on an altered dress.

North of the Dividing Range, c, there is a larger mass of migratory birds than in the south, e.g. the chats (*Ephthianura*), one red, the other yellow. When meeting the mountain bar the food becomes less, and many birds considering they have come far enough southward, stay and feed and nest. The lesson of many generations, extending over many centuries, is to come south to the same areas, each to its kind.

The present day species, incoming with the spring, make for the old nesting grounds. If the previous season has been a dry one, and seeds and insects are in small supply, many birds will cross over the smaller hills and relieve the strain on the food supply in the usual nesting grounds. It is then that naturalists will record strange birds being



MAP 56

Herons of the Derwent Estuary (Extreme south of Australia).

- a. Reef Heron (*Demigretta sacra*).
- b. White-fronted Heron (*Notophoyx novæ hollandiæ*).
- c. Nankeen Night Heron (*Nycticorax*).
- c. Pacific Heron (*N. pacificus*).

found on the Keilor and Werribee Plains. When the ordinary weather returns, the birds will keep to the northern side of the Divide.

DISCONTINUOUS DISTRIBUTION

Scrub-Birds.

East —— West.

Colour Pattern.

An example of the station or broken distribution of a species is given in maps 49 and 50, and at the same time it is a good case of eastern and western representation of the same bird. These species also indicate coastal habitat extending from the sub-tropical brushes to the extra tropical forests. A genus of two species $a^1 b^1$ is represented far away in the west by two races $a^2 b^2$, the Bristle Birds (*Sphenura*). Between these two areas the country has been altered and the connecting links have disappeared. Map 51 to indicate colour pattern shows the approximate living ground of a Yellow Robin (m), a Red-capped Robin (n), and a Brown Scrub Robin (o).

Yellow Robins love the quiet of forest vegetation, Red-capped Robins the broad edge of the mallee gum country, and the Brown Scrub Robins within the mallee scrub.

The Yellow Robin is an *eopsaltria*, meaning psalm of dawn, and the lovely form of this jonquil coloured bird, as it silently passes from tree to tree, is most attractive.



MAP 57

Best known Crakes and Rails:—

- a. Pectoral Rail (*Hypotænidia*).
- b. Spotted Crake (*Porzana fluminea*).
- c. Little Crake (*P. pusilla*).

The Red-capped Robin with its brilliant reds and blacks is a bush jewel, building a charming nest in keeping with its personal beauty.

The Scrub Robin is a brown bird of plain plumage and with long strong legs developed for the purpose of its ground life. It fills the niche in the dry scrubs of the lower Murray River.

HABITATS OF DOTTRELS

(Plate 2, Fig. 52)

Interior.

Hinterland.

Coastal.

Our dottrels come of a world wide family, some of which are only visitors from Siberia; others being local and with us at all times. A few of these Siberian species, with great social instinct, come as far south as "a" in map 52, and others to "d." Of the non-migrating species the Red-kneed species stays in b, and the Double-banded in c, d. The Red-capped Dottrel covers all the ground in Australia, but is not a resident of Siberia as well.

In April of each year the migrating species leave their winter ground (Victoria) and go north to Corea (Chosan) where they wait for the still more northern snow to melt. While doing so they change their plumage, getting into the marriage suit. I have been very interested in seeing these changing birds on the rice fields of Japan, where



MAP 58

Gull Family: Terns:—

- a. Sea Terns.
- b. Land Terns.
- c. Sea and Land Terns.

- a¹. White-faced Ternlet (*Sternula nereis*).
- a². White-shafted Ternlet (*S. albifrons*).
- b¹. Marsh Tern (*Chlidonias lencopareia*).
(Parts of the old world).
- b². Gull-billed Tern (*Gelochelidon nilotica*).
(Parts of old world and America).
- c¹. White-winged Tern (*C. leucoptera*).

they associate with the curlews and godwits in thousands.

According to the Russian calendar they pass Vladivostock northwards on a regular date. I once had the experience of being in this eastern city on a dark stormy night when the black air was full of straying birds with anxious calls.

The Red-cap is the smallest of our dottrels; the Double-band about the largest, the band being a protective device. The sandy coloured young of these birds run as soon as hatched. The origin of nest building is in this family.

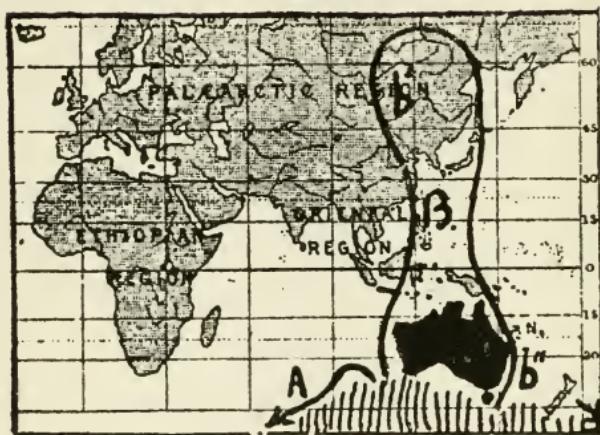
DISTRIBUTION

- a. Height: Highland and Lowland Parrots.
- b. Breadth: Spine-billed Honeyeaters.

Thousands of birds go up the mountains in the spring of the year. The King Lory with its brush tongue is one example, map 53, a³, the northern race being a⁴. It is a highland bird in summer and a cold lowland bird in winter.

The Mallee parrots are the birds keeping to the dry lowlands throughout the year.

The Spine-billed Honey-eater is broadly distributed and found in the same country as the King Parrot, ascending the mountains to the same altitude and returning to the depths in Autumn. This is their Bathic migration in the eastern range. In Western Australia the same genus has a white brow as the clan recognition mark. In this we have



MAP 59

Parasitic Gulls:—

- A—Southern Skua (*Catharacta*).
B—Arctic Skuas (*Stercorarius*).
b¹. Nesting Ground (June).
b². Winter Ground (December).

an example of the greatest breadth of distribution in Australia.

The eastern spinebills are very variable; two island races, one in the tropics and two in the south. Of these latter, one belongs to the dry belt, the other to the moist forests. This ruby-eyed bird flutters beneath an arbutulon as the humming bird does below a cactus flower.

The King Parrot, with brilliant scarlet head, lays round white eggs deep down the hollow of a giant gum tree in a forest depth. The young are green and do not mature before the third year. The Satin-bower Bird of the same forest takes two years longer to mature. A third genus of the same scrubs, the Whistlers (*Pachycephala*), matures in much less time.

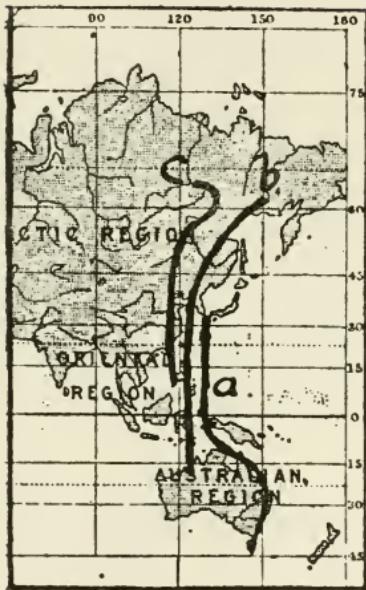
OWLS: HIGHLAND AND LOWLAND

In Australia we have no miniature owls such as are found in the East Indies. But we have an extremely large one, the Powerful Owl, living among the spurs of the eastern ranges.

What does particularly interest us is the distribution of our owls in two sections; one of which keeps to the plains between Port Phillip and the Gulf of Carpentaria, and the other in all that country east of it.

Map 53a shows two examples of parallel habitat:

The Black Owl of the mountains (*Tyto tenebri-cosa*).



MAP 60

Migration routes of Snipe.

- a. Australian Snipe (*Gallinago australis*).
- b. Eastern Snipe (*G. megala*).
- c. European Snipe (*G. gallinago*).

The White Owl of the plains (*T. longimembris*).

Owls have facial discs, and they do not see laterally as most birds do. Their plumage is so soft as to be able to quickly follow up the advantage of sharp eyes. In some owls there are two sets of down feathers before the ordinary plumage arrives.

Food is composed of the animal life peculiar to the hills or the plains, and each type of owl helps to keep the balance of nature.

The White or Grass Owl has particularly long legs, using them freely as a ground feeder. It camps mostly under tussocks. If a plague of mice enters Victoria from Queensland the owls will follow. The range of this owl is across to India.

EXTENSIVE SHORE LINE

Continental.

Insular.

(Plate 2, Fig. 54)

The White-eye (*Zosterops*) comes of a remarkable family. In the first place it has a continental distribution in Australia only, keeping away from the dead heart with its ordinary annual rainfall of $4\frac{1}{2}$ inches.

Like the glou morceau among pear trees it has a love of the sea, if one may judge from map 54. In the extra Australian lands the sea coasts attract it. In the extreme north-east limit of its range, Japan claims the White-eye as the largest of its kind, and insular. Off our own coasts in Torres



MAP 61

Arctic Rookeries (a. b. c.) and Winter Grounds (d.):

- a. Curlew.
- b. Whimbrel.
- c. Godwit.

Strait, and Kangaroo Island and Tasmania we have races.

Further away we know that different races occur on the New Hebrides, Fiji and New Caledonia.

The Commonwealth has over a dozen species of the White-eye living like the White-face on the co-operative system. In the more settled districts during the fruit season they give rise to much criticism. Grapes and figs fare badly. Its food during most of the year is the destructive blight insect. So it remains for fertile brains to discover ways of frightening away the birds as the fruit ripens.

The White-eye is one of the few Australian birds which lay eggs of a bluish colour in a delicately built nest, a few feet above the ground.

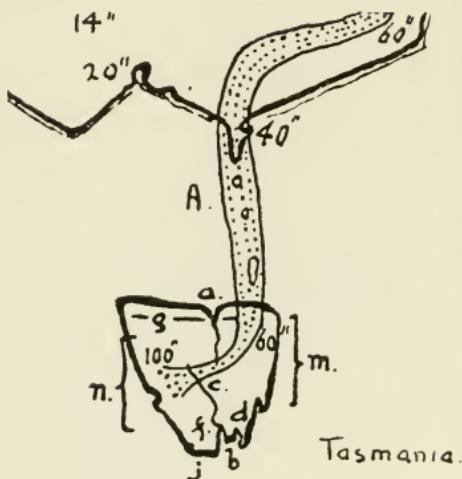
WHITE-EYES (*Zosterops*)

(Plate 2, Fig. 54)

- A. The Golden White-eye and its races.
- B. The Grey White-eyes.

White eyes are closely related to the family of Honey-eaters (*Meliphagidae*). We are guided in saying so by the brush like tongues in each. One family mostly lays pinkish eggs, the other bluish.

The northern half of Australia gives a colour effect to its birds, a good example being shown in map 55 A, the Golden White-eye (*Z. gulliveri*). If the tropics were not where they are, all the twelve species of White-eyes would be grey. As



MAP 62

Southern extremity of Bassian sub-region.
(Direction of high level chain, along which
birds migrated).

- a. Tidal species (River Tamar).
- b. Ocean: Penguins and Albatrosses (Estuary of Derwent).
- c. The Lake country for ducks in summer (Table-lands).
- d. Dry-country birds, e.g. Ground Thrush (*Cinclosoma*).
- e. Wet country birds, e.g., Mountain Thrush (*Oreocincla*).
- g. Bulk of mainland migratory birds found here.
- j. Bulk of petrel family pass here.
- m. Eastern races } of same species.
- n. Western races }

it is we find all the greys in B. The heat of the north has given a golden effect to all the White-eyes of the north.

These two sections again vary, this time along each line from east to west. It is climatic in conjunction with the different types of country. The variety of timber and the composition of the earth play their parts. In the north it is a thousand miles of mangrove, a. b. c. d. In the south it is the thousand miles of low growing vegetation that fringes the Great Australian Bight, individually altering previous effects in plumages f. g. i. Again in a different way the massive forests of Gippsland stamp the feather dress with the hue of their own territory. The Grey-backed White-eye (*Z. gouldi*) freely travels over the Bight, the Grey White-eye (*Z. dorsalis*) within Gippsland.

HERONS

1. Inland; 2. Sea.

Heron-like birds form an order and get together as a most fascinating group: Ibises, Spoon-bills, Egrets, Storks and True Herons. They all have of necessity long necks because every one has long legs. The Jabiru of the back waters is the only Australian stork.

True Herons include egrets and bittern; some of which keep to sea coasts, while others associate on inland swamps.



MAP 63

Relationships and Migration.

- a. Bewick's white swan with colour pattern opposite to that of the black swan of Tasmania.
Nesting ground of several species of birds which migrate to Tasmania.
- b. Tundra and pine forest boundary.
- c. Most northerly nesting ground of Australian Swift (*Micropus*).
- d. Nesting ground of Australian Snipe (*Gallinago australis*).
- e. Meeting ground of Australian and Palæarctic forms (*Megapode*—*Loxia*).
- f. Wallace's line dividing Australian and Asiatic birds.
- g. Certain birds migrate from here in winter.
- h. Isolated genus of coot (Mortier's waterfowl).

The Pacific Heron, better known as the White-necked species, keeps to Australia proper, while the White-fronted Heron, known as the Blue Crane, is found further afield; New Zealand and the Phillipine Islands, map 56.

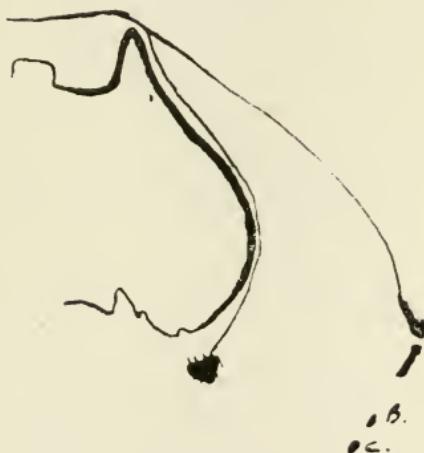
The most widely distributed member of the Australian set is the Reef Heron. It nests also on the islands of Fiji, Japan and many Polynesian points.

That the bird should have two phases of colour, as with the Gouldian Finch, is very puzzling. The breeding birds may be pure white, or they may be slaty blue making the bird sporadic and dimorphic. They frequent reefs of all sorts, and add to the beauty of lonely scenes.

Egrets are handsome birds when in full summer plumes. In a colonial nesting bed of red gums, they make a lovely picture. Their rookeries are placed where frogs are counted by the thousand, and where water flowers and tall bull rushes grow.

Amongst the reeds and tangle the Bitterns boom. The Mangrove Bitterns are mostly northern species, one of the three species being found in the Upper Darling waters and as far south as the big scrubs of the Darling River. The largest and the smallest Bitterns are found all over Australia. Bitterns have procryptic colouration.

The Nankeen Night-Heron, as its name implies, is nocturnal. In day light it sleeps on the tops of tall trees. When the twilight comes the bird fishes by the water side, keeping eyes specially alert for



MAP 64

Migration flights; normal and abnormal.

Migratory birds, from Siberia, e.g., Godwit, divide at Papua for Tasmania and New Zealand.

B—The most southerly snipe: Auckland Island.

C—The most southerly habitat of rails and parrots (abnormal) Macquarie Island.

frogs. It lays pale blue eggs, southward in Tasmania or away in the Pelew Islands.

RAILS AND CRAKES

(Plate 2, Fig 57)

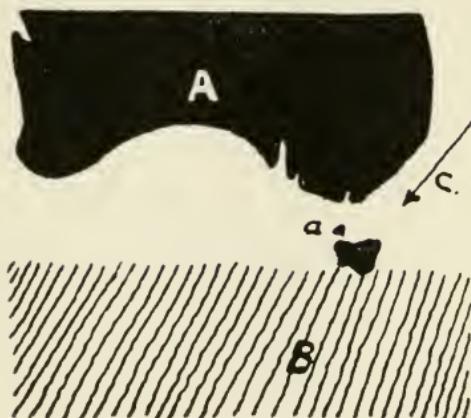
There are five species of Rails and five different Crakes in Australia. One of the latter is only a visitor from Asia and is classed as a stray. The usual custom is to leave China in Autumn and fly south to Sumatra. We have discovered that one bird overflowed its country and landed in New South Wales, the Corn Crake of Europe and Asia.

Map 57 shows "a" the Pectoral Rail to have a deep range of distribution with an eastern diversion from the type (sub sp. *mellori*), and from the common range.

The largest of our rails, the Chestnut-bellied Rail is purely a northern bird.

The Spotted Crake frequents the damp spots between eastern Queensland and southern Tasmania. A leafy staging leads from the water to the nest and the eggs are brownish olive, rather unusual among birds.

Rails and Crakes are shy sensitive birds, as I gather from a nest of eggs of the Pectoral Rail collected in September. Having discovered the nest of eggs I counted them and left them till my return in the afternoon. Then I found they had all been removed to a quickly made rough nest some dozen yards away. The birds had lifted them, one



MAP 65

Tasmanian Seas:

A B—Land-and sea-birds of the Temperate zone:

A—Open-toed birds.

B—Web-toed birds.

B—The region of visitors from the southern waters e.g. King Penguin and petrels from east to west.

a—Nesting ground of White-capped Albatross.

C—Direction of sub-tropical strays e.g. Red-tailed Tropic-bird.

by one, so I left them to her tender forethought and care.

THE GULL FAMILY (TERNS)

(Plate 1, Fig. 9)

- a. Sea Terns.
- b. Land Terns.
- c. Sea and Land Terns.

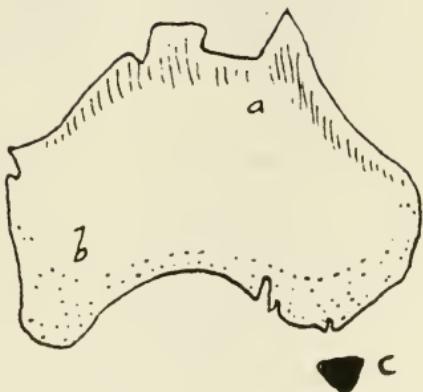
The Terns are the straight-billed section of the family; the Australian waters having eighteen species. Map 58 shows their approximate field with examples.

The great mass of terns is tropical and the Sooty and Noddy species are the most numerous.

Sea terns offer two experiences in one's life, the first a visit to the Great Barrier Reef, and the second to the Abrolhos Coral Islands. On the latter I have seen a thousand nests of the Noddy upon the low salt-bushes, and a thousand of the Sooty on the ground beneath those bushes. To add to the wonder of it, there were a thousand petrels nesting in the holes of the ground below the tern nests.

The quiet of the day was relieved by the voice of the terns, the dark of the night by the sounds of the petrels. Homoplasmy or the action of a like environment has caused the gull and petrel to appear alike. Gulls are related to the plover tribe.

The land Terns are very graceful and fork-tailed, keeping to the rivers and marshes to nest, sometimes using the deserted nests of grebes.



MAP 66

Complete absence of large families from Tasmania
e.g. Flyeater (*Gerygone*).

- a. Stronghold of several species and races.
- b. Species of *Gerygone* and races.
- c. Flyeater family (*Gerygone*) absent.

The White-winged Tern associates with the land tern upon the swamps, in addition to travelling across the waters of the Austro-Malay Archipelago.

PARASITIC GULLS

Sub Arctic.

Australia.

Sub Antarctic.

Every year Southern Australia is visited by Skua Gulls; the partial parasites of other gulls. Some come from their nesting ground in the tundra of Siberia, others from their nesting grounds on the sub-antarctic islands, map 59. My experience has been with each and I must say they are fearsome birds, cruel and greedy. They steal and eat the young of their closest relatives. Mother Carey's chickens (Wilson's Petrel; *Oceanites oceanicus*) are promptly gobbled up in the twilight if they show themselves, or are late in returning with the sun rise. The Skuas walk among the rookeries of cormorants, and if the eggs are left for a moment they are stolen, cracked and swallowed. Boldness is shown in the way the birds approach any man resting at his mid-day meal with wild ducks recently killed behind him. They come quietly and eat their prize on the spot as if mere man were beyond consideration. The Southern Skua is probably the Australian race of the Falkland Island Skua.



MAP 67

Island distribution, connecting avifauna; a—Cape
Barren Goose (*Cereopsis*).

A third skua comes from Asia to the northern shores of Australia, and with it we get two distinct and opposite phases of plumage colour showing continuous variation.

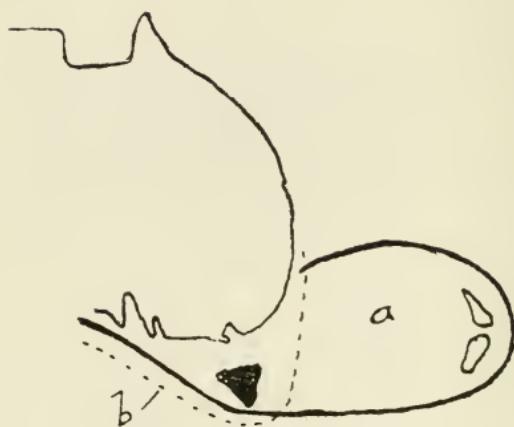
MIGRATION OF SNIPE

The north—south annual migration of the large snipe is indicated in map 60. The European Snipe is really Asiatic as well, the term holarctic being the correct one to use.

The Eastern Snipe each year comes south in the spring to Northern Australia, and returns to northern high latitudes in the following February—March.

The Australian Snipe is not wholly Australian, as it is born in Manchuria or in Japan, and regularly migrates between Tasmania and the 50th parallel of northern latitude. It is remarkable that these "long bills" all meet in their migration on the Phillipines. *Gallinago australis* nests in the grassy flats at the base of the sacred Fujiyama at an altitude of some 3,000 feet. If disturbed it indulges in fancy flights with weird wing noises. The young as soon as they are strong enough to leave their snow topped Fujiyama fly southward and make for the feeding swamps of their parents; in southern Gippsland for example.

By September or October the majority of snipe have arrived. Worms, mellipedes and damp ground



MAP 68

Tasmanian and New Zealand waters:

- a. Diving Petrel (*Pelecanoides*).
- b. Silver and Pacific Gulls (Bassian races).
Black Oyster-catcher (*Hæmatopus fuliginosus*).

insects are its food. They follow the edge of the drying waters.

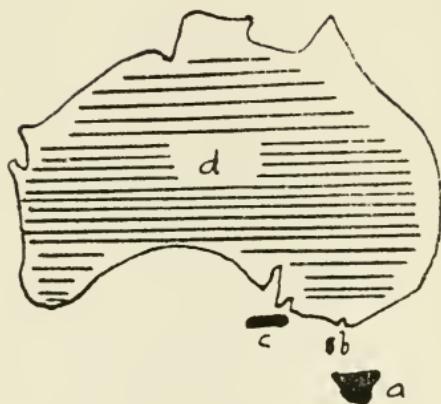
The best place to look for snipe in southern Australia is not in the fen ground but in the dry sandy rises among fern and heath. Later in the season they lie in the shade of large trees and frequent the tea tree of the morass. As the waters dry they pack in the remaining rushes of the creeks giving preference to certain spots.

ARCTIC AND SUB-ANTARCTIC ROOKERIES AND WINTER GROUNDS

(Plate 1, Fig. 6)

Away in frozen northern Asia immense flocks of Australian birds are associating. The time is May. They are waiting within a thousand miles of the rookeries for the melting of the snow. These are the birds we saw on Tasmanian coasts a month ago, restless, calling, and congregating for the great flight that will land them in the richest feeding ground of the Polar basin. There they will breed, but not rear their young. It is reserved for the winter ground of September—March in the southern States of the Commonwealth.

The rookeries, though extensive, are scarcely visible as great affairs. Apologies for nests are far flung upon the frozen ground but not seen, even though the birds are flying everywhere; wheeling, opening and closing with the precision of a trained troupe. Associated in these endless flocks are Cur-



MAP 69

Emus; extinct and living (*Dromaius*).

- a b c—Three fossil emus.
a. Tasmanian Emu.
b. King Island Emu.
c. Kangaroo Island Emu.
d. The living Emu.

lews, Sanderlings, and Dunlins; Whimbrels, Green-shanks, Sandpipers and larger Plover; Godwits of the east and Godwits of the west. The wonder is that the multitude of the eastern birds makes south to New South Wales, and the western birds go to South Africa, while all have nested in close vicinity.

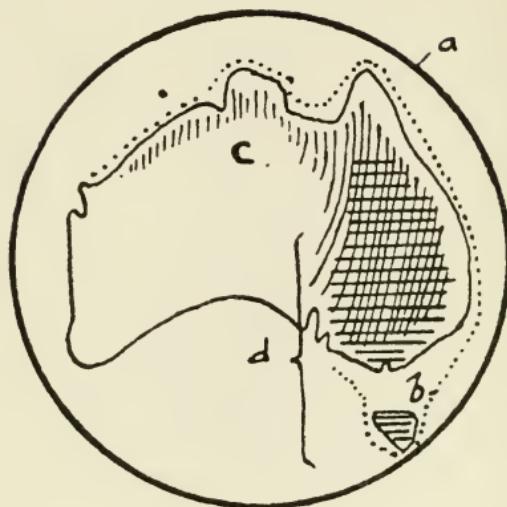
Map 61 b, c, is the treeless land with reindeer mosses, frozen a foot beneath the surface. Yet that surface is crowded with thawing berries, the food of countless birds—the Australian Little Stint, Snow Finches and Siberian Blue-throats. The last winters in India and Africa, and it will be most exciting if it is ever discovered in Australia because it is the loveliest of things.

TASMANIA

Area 5

Tasmania has a wonderful ocean bird-fauna, as remarkable though not as conspicuous as that of the Queensland coast. Petrels travel in vast flocks and penguins in shoals. Circumpolar birds pass in the winter and mostly nest away in the summer. Smaller albatrosses have their beaten tracts in certain portions of this sea and in the roaring forties.

Land birds annually migrate to Queensland or to a lesser extent, remain in the neighbourhood of their birth. Some keep entirely to the forest,



MAP 70

Distribution of hawk-like birds found southward to the estuary of the Derwent River:

- a. Black-cheeked Falcon (*Falco peregrinus*).
Little Falcon (*F. longipennis*).
Brown Hawk (*Iericidea berigora*).
Kestrel (*Cerchneis*).
Wedge-tail Eagle (*Uroætus*).
- b. White-bellied Sea-eagle (*Haliætus leucogaster*).
White-headed Osprey (*Pandion*) extending along West Australia.
- c. Grey Goshawk (*Astur clarus*).
- d. Allied Harrier (*Circus a. gouldi*).
Eastern Sparrow Hawk (*Accipiter cirrhocephalus*) race W.A.

others to the open. The shore fauna has many local races. The whole shore fauna is not so local. Many species cross and recross the Bass Strait, one small dottrel flying to Siberia to nest and return each year.

There are several interesting centres, e.g. the Derwent estuary, (map 62 b.). This estuary opens into the best of our bays for penguins, the smaller petrels and albatrosses. It is the southern extremity of the Bassian sub-region, a part of the broken chain along which the birds used to travel from Victoria in their annual migration.

Eastern and western island representation is shown in m, n, map 62. This is owing to the east being dry and open, and the west wet with heavy rainfall forests.

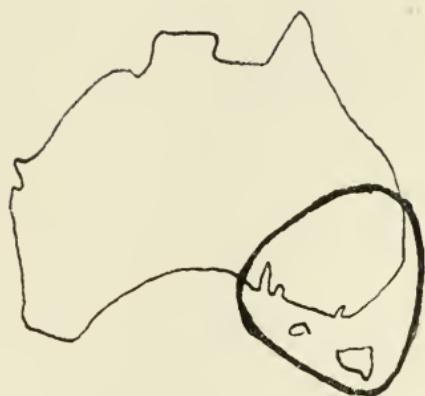
Tasmania is not a rich feeding ground, berries being few, eucalypts not satisfying, and sand beaches too clean. The animals actually here are just as fully interesting and serve as compensation for the lack of number.

RELATIONSHIPS AND MIGRATIONS

(Plate 2, Fig. 36; Pl. 1, Fig. 8; Pl. 2, Fig. 61)

Tasmanian birds are: 1. Asiatic, as visitors; 2. Closely related to the Indian fauna; 3. Derived from birds of the mainland, particularly that portion which is east of Port Phillip.

Forests largely determine the types of birds occupied by them, e.g. the vast pine country in



MAP 71

Fire-tailed Finch (*Zonæginthus bellus*), a; (the only representative of the family in Tasmania)

northern Asia has innumerable quantities of finches. These are birds with beaks suitable to break the tough food supplied by conifer trees.

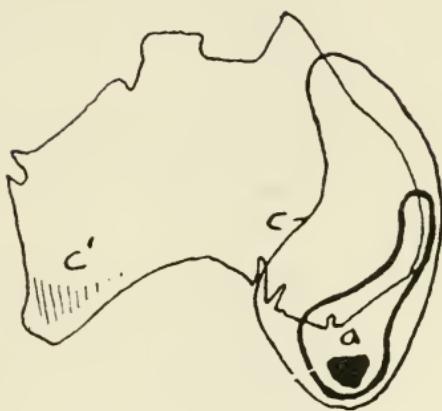
In Australia and Tasmania we have the main forests bearing sweet liquid flowers, so that those forests have an extensive family of honey-eating birds absent from Asia.

The Indian and Australian Regions have certain perching birds in common, e.g. Bee-eater (*Merops*) and Wood Swallow (*Artamus*). The relationship is an ancient one.

It is wonderful that Wallace's line, g, map 63, proves itself a barrier to distribution; on one side the fauna being largely Asiatic, on the other, Australian.

There are examples of birds whose ancestors were somewhat alike but whose descendants now live isolated lives on each side of Wallace's line. At the delta of the Lena River a local water fowl (Diver) is found, while in the estuary of the Derwent River a second one (Mortier's Coot) is common. The Tasmanian migratory birds pass over the 8,000 miles separating these two water fowl, making a return journey of it in the year. The Diver migrates up the Lena River each spring, the Coot does not move. Here we have internal migration, and a complete local habitat.

True migration is a big affair. The snipe (e) will breed in Japan, the swift (d) in the market place of Yakutsk, the centre of the fur trade in mid-



MAP 72
Parrot-like birds.

- a. Gang-gang Cockatoo (*Callocephalon*).
- c. Broad-tailed Parrots (*Platycercus*).
- c' Western representation of Rosella Parrot.

Siberia. It is there I have collected eggs now in the Tring Museum.

The Marshtringa and the Greenshank birds well-known to sportsmen, go to the limit of migration, the Arctic shores; and to the wonder of us all in Southern Tasmania return in the yellow-haired September.

MIGRATION FLIGHTS

Normal and Abnormal.

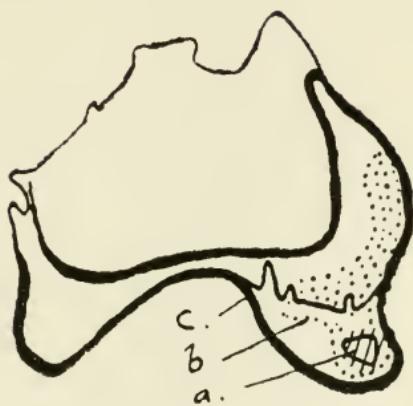
(Plate 2, Figs. 61, 57)

Most of the birds of the order Charadriiformes, or Limicoleæ, which means dwellers of the mud, are shore birds. They are mostly migratory and wing their way from summer to summer never knowing a winter.

On entering Siberia in April they may, and probably do, encounter a blizzard of the most terrifying nature. On return in September they meet the sixty miles an hour wind and fly high. From this time on the flocks are ready for the quiet of a secluded beach.

Map 64, A, is the parting ground of immigrating flocks of waders. Some go on to New Zealand while most are making for the eastern shore line of Australia a few of whom will continue to the southern land shelf of Tasmania.

The North Cape of New Zealand in March is one of the most fascinating parts of the world,



MAP 73

Diamond Birds (*Pardalotus*).

- a. Forty-spotted Pardalote (*P. quadragintus*).
- b. Eastern Yellow-tipped Pardalote (*P. affinis*).
(race of *P. striatus*).
- c. Spotted Pardalote (*P. punctatus*).

because a thousand Godwits have congregated, and are over anxious to return to the land of their birth in Siberia. They have all the nervous ways of a people about to cross an uncharted sea.

One of the abnormal giant flights of non-migrating birds is seen in c, map 64. Parrots and Rails through an unexpected cause have got to c, the Macquarie Islands. There they live an unenviable life, without trees and on soils that are super-saturated.

Birds that get far out in these seas with an off-shore gale either drown, get temporary sanctuary on a ship, or meet a desolate island. The rails and parrots in this case had the better fortune to be blown on the Macquarie Island, so well-known as a base of Antarctic expeditions.

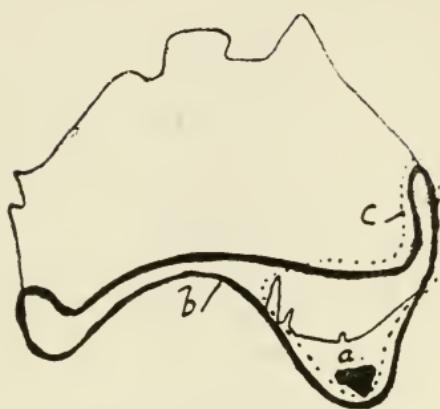
TASMANIAN SEAS

Littoral and Pelagic.

(Plate 3, Fig. 91)

Coast-line birds are the littoral species, being open toed if terrestrial, and webbed if marine. The food of one is insects roaming the grass and bushes. The feeding ground of the other is in the sea, or on its surface, where vast millions of small crustacea live.

We have a fauna that keeps almost entirely to the salt bushes of the coast, while certain trees give preference to the shoreline. These trees har-



MAP 74

The Distribution of Tasmanian Honey-eaters:

- a. Noisy Miner (*Myzomela garrula*).
 Yellow-wattle bird (*Anthochaera paradoxa*).
 Yellow-throated Honey-eater (*Ptilotis flavigula*).
 Strong-billed Honey-eater (*Melithreptus validirostris*).
 Black-headed Honey-eater (*M. melanocephalus*).
 Tasmanian Spine-bill, a race of the eastern species
 (*Acanthorhynchus tenuirostris*).
- b. Tawny-crowned Honey-eater (*Glyciphila*).
 White-bearded Honey-eater (*Meliornis novae hollandiae*).
 Brush Wattle-bird (*Annelobia mellivora*).
- c. Crescent Honey-eater (*Meliornis pyrrhoptera*).

bour insects that do not live inland, so conservative birds in their cupboard love of the coast identify themselves as part of it.

Some birds come to the coast to winter, others to summer. Many Honey-eaters live their whole life by it. Field Wrens (*Calamanthus*) are very dependable as dwellers in the salt bush.

The Silver Gull is web-footed, and a frequenter of the beach, coming close to the settlement. The Pacific Gull, a large brown bird when young and mostly snow white when adult is the largest scavenger of the sands. Far away from the cities and from the haunts of man, the Red-bills or Oyster-Catchers take up their solitary stands on the open beaches. These birds are only partly web-footed, the outer toe being joined to the middle one by a web. There is no hind toe to support it.

The ocean cares for the pelagic birds, and they come in to the dunes or the rocks when the season arrives for nesting.

The family that thinly veils the vast ocean is made up of birds with special noses, definite tubes as nostrils. In it is included all the albatrosses, whale-birds and small petrels. Their food is principally squids or cephalopods; the ocean teeming with them.



MAP 75

Main migration line of South Australian birds:

Bee-eater (Merops) Port Augusta to Papua, via
Diamantina River.

Blue-bellied Lorikeet (Trichoglossus novæ hol-
landiæ) Eyre Peninsula—North Queensland.

COMPLETE ABSENCE OF LARGE FAMILIES FROM TASMANIA

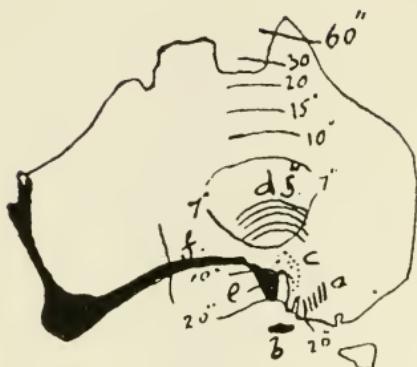
(Plate 1, Figs. 28, 82)

Tasmania is the stronghold of Southern Ocean families as a compensation for its weakness in land families. Some fifty thousand years ago it was joined to Victoria, and that was the opportunity for many Australian families to have gone south to Tasmania. They did not take advantage of the land bridge, possibly because of the poor food supply, and therefore missed their opportunity. Bass Strait formed and made a barrier to dispersal. *Gerygone*, a family of flyeaters, is one example as shown in map 66. Why Tasmania should be without it and New Zealand with it, or its first cousin, is not due to modern influences. It must date far back when New Zealand was connected with "a" map 66, and when Victoria had no gerygones. The word means eater of wasps: and it is possible we did not have the proper kind of wasps. Similarly in Tasmania there is no mistletoe bird, because there are no mistletoe berries.

Menura the Lyre Bird, Psitta the Tree-runner and Climacteris the Tree-creeper, are remarkable mainland families absent from Tasmania.

If Antigone the Crane had got across, it would have found a living in the estuaries rather than starve in the absence of plains.

Tasmanian plains are made up largely of button grass and do not offer much encouragement in the way of food supply.



MAP 76

Key to distribution of the races of a species in
South Australia.

- a. Connecting Robins (Bassian-Eyrean).
- b. Insular race of a.
- c. Paler race of a.
- d. Interior race of a.
- e. Peninsula race of a.
- f. Western race of a.

Rainfall annual average 20in., 10in., 5in.

ISLAND DISTRIBUTION

1. Racial; 2. Non-racial

(Plate 1, Figs. 6, 30; Plate 2, Fig. 61)

Tasmania, King, Flinders and Kangaroo are four young islands that regularly have the same species. Most of them get the overflow from the main part of the Bassian sub-region (N.S.W.-Vic.). Those which have become stationary in Tasmania are already subject to geographical effect. This gives the racial differences. Food and forest; moist or dry; warm or cold; and the feathers remain as they are or darken. They deepen their plumage colour. A species living on a large bushy swamp, rather than on an open scrub, in a few generations changes its colour sufficiently to make a race of the species. There are many such examples that have not yet been studied in Australia, and it is to be the work of many all round naturalists to supply the information.

Map 67 associates the islands of Bass Strait with South and South West Australia, through the agency of the Cape Barren Goose. It is a unique goose and there is one race of it; in South Western Australia.

The non-racial birds are the wanderers which annually travel over many countries, and are beyond local influences. The Grey Plover, Turnstone, Greenshank and several high-flying birds are amongst them and thoroughly cosmopolitan.



MAP 77

Southern Australian races of the Australian
Tit-Warbler (Acanthiza).

- a. Lower Murray Little Tit-Warbler.
 - b. Kangaroo Island Brown Tit-Warbler.
 - c. Venus Bay Brown Tit-Warbler.
 - d. White-vented Brown Tit-Warbler.
 - e. Mt. Lofty Striated Tit-Warbler.
 - e'. Kangaroo Island Striated Tit-Warbler.
 - f. Eyre Peninsula Chestnut-rumped Tit-Warbler.
 - g. Port Augusta Chestnut-rumped Tit-Warbler.
 - g'. Interior Chestnut-rumped Tit-Warbler.
 - h. Southern Yellow-rumped Tit-Warbler.
 - h'. Adelaide Yellow-rumped Tit-Warbler.
 - j. Interior Yellow-rumped Tit-Warbler.
 - j'. Port Augusta Yellow-rumped Tit-Warbler.
 - k. Southern Buff Yellow-rumped Tit-Warbler.
 - l. Southern Thin-billed Tit-Warbler.
 - m. Interior Brown Tit-Warbler.
- A B—Distribution of a Tit-Warbler in a belt of 7 inch annual rainfall along 1,000 miles east—west (A. robustirostris);
- A—Musgrave Range; B—Murchison E. Range, Thick-billed Tit-Warbler.

TASMANIAN AND NEW ZEALAND WATERS

(Plate 2, Fig. 54; Plate 3, Figs. 93, 98)

Tasmania and New Zealand are parts of the Australian Region, though the land birds are so very different as to make one wonder however they could be placed in the one and same region. Even the water birds are subject to more and greater geographical differences than in Tasmania which has only two minor associated groups of islands. New Zealand has the sub-antarctic groups of islands far removed from each other. It also has two groups of Polynesian outliers which give two large and quite different assemblages of birds.

Both Tasmania and New Zealand originally got their land birds from the Papuan sub-region; the first as a matter of a few thousand years ago, the second, one of hundreds of thousands.

Map 68 shows a connecting species, the Diving Petrel. It is a feeble flier but like the penguins it can keep to the sea for weeks at a time. It has in fact become a short-legged, highly specialised form of diving bird. The Silver and Pacific Gulls are shown at b.

The Crested Penguin is common to both; while the islands of New Zealand are rich in penguins, having no less than eight species. Tasmania, as a dependency with no national far flung appendages, has only two species, one being the smallest known.



MAP 78

Variation in a species from east to west; A—C

1. White-eared Honey-eater (*Ptilotis leucotis*).
 2. Brown-headed Honey-eater (*Melithreptis brevirostris*).
 - a. Kangaroo Island race
 - b. Port Augusta race
 - c. Interior race
 - d. Western race
- }

} Races in
} South Australia.

It is remarkable that the Tasmanian and New Zealand cormorants have their origin in the Antarctic as well as in the northern hemisphere. One species is found all the way between Sharks Bay and Stewart Island.

The two species of Oyster catchers are common to each. Though the Bustard and Crane are found in Victoria, New South Wales and Queensland neither occurs in Tasmania nor in New Zealand.

The true quail (*Coturnix*) found in Tasmania has become extinct in New Zealand. The Tasmanian Dusky Fantail is darker in New Zealand, and, spreading rapidly it is pressing out the earlier fantail.

The White-eye (*Zosterops*) has been a long time in Tasmania and is a recent introduction to New Zealand. The Pipit is an older resident in the Dominion, and is losing the power of flight on the small islands. Long isolation is working a more wonderful change in the birds of New Zealand than in the modern and accessible Tasmania.

EMUS (Dromæidae), *dromos*, a running; *eidos*, form

1. Extinct; 2. Living.

Many centuries ago when adult emus were small they were flying birds. For reasons unknown to us they took to themselves a ground life, and lost the use of their wing muscles. Their wings dwarfed and their bodies grew to a huge size.



MAP 79

1. Colour-grading in a species 5—1 White-plumed Honey-eater (*Meliphaga penicillata*) the five races lessening in intensity from 5 to 1.
2. Long direct range in distribution of a race of the species *M. penicillata* a b c. This is the Leilavale race; a. Cloncurry; b. Central Australia; c. Flinders Range.

Four centuries ago, the emu was christened *dromæus* a runner, and to-day all over the world, it still holds good.

In 1642, when Tasman landed in Southern Tasmania the emu was numerous. Now it is extinct. It was a dark race of the mainland bird. The primitive native killed off excess of broods and with the incoming of civilisation in the early part of last century the last of them disappeared.

Map 69, b, has a King Island race which, also, is extinct. Cultivation and cattle raising have made it impossible for the last of the emus to be still living even in the rank tea tree swamps.

The last of the Kangaroo Island race, c, is at present in a European Museum. All that remains to us is the mainland species, well distributed over Australia, excepting the rich scrubs of Queensland. The north-west desert country has a sandy coloured race of it.

In the thick tropical scrub the cassowary takes its place. This cassowary is a member of another family of the order which is limited to birds having a feeble keel.

HAWK-LIKE BIRDS

Though Tasmania has a large quota of Australian hawks, no one species is peculiar to the State.

The very swift flying and handsome Black-cheeked Falcon, map 70, "a," gets as far north as



MAP 80

Chain distribution: Red-browed Finch (*Aegintha temporalis*).

4. The species.
- 3—5. Terminal races.
 3. The paler race, Highlands of South Australia.
 5. The small race, Cape York Peninsula.

the Moluccas. It loves bold rocky country and will return each year to its old nesting haunt; some seasons repairing the old nest.

The Little Falcon is the smallest of our hawks.

Tasmania and Australia have a land eagle and a sea eagle, b, the former being the largest flying bird in the Commonwealth, and the sea eagle is the second.

The Osprey, a fish eating hawk, is to be found in Bass Strait.

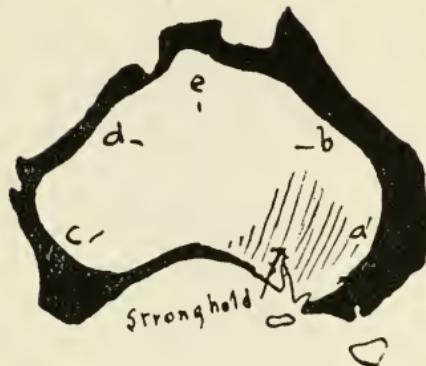
Other hawks include the Kestrel, ground-feeding Harriers, Brown Hawk, Sparrow Hawk and the pure white Gos Hawk.

The Kites have not yet appeared as far south as Tasmania and as a hunting ground for the Buzzard it is not warm enough.

The Harriers are the long-legged ground or swamp Hawks, living upon most things meaty, not too large to catch, and small enough to swallow. Cancerous mice are greedily swallowed. The common harrier lays white eggs in a swamp nest and will resort to it year after year, if not disturbed.

THE FINCH FAMILY

The only finch found in Tasmania is a good example of feeble or unit representation. It is classed among the weavers, known as a sub family of most lovely birds. Their colours compete with



MAP 81

Chestnut-eared Finch (Zebra Finch) and its races
(*Tæniopygia castanotis*).

- a. Race with orange bill.
- b. Race with paler flanks.
- c. Race with vermillion bill.
- d. Race being palest.
- e. Race greyer above than b; the upper surface brown.

anything in nature, naturally making them an attractive family.

The most southern species is the Fire-tail (*Zonæginthus bellus*) meaning zone belt; aiginthus, a hedge sparrow, and bellus, beautiful. It belongs to the order of sparrows, having a brilliant scarlet rump.

There are more than twenty species of finches, yet only one of them is found in this isolated island state.

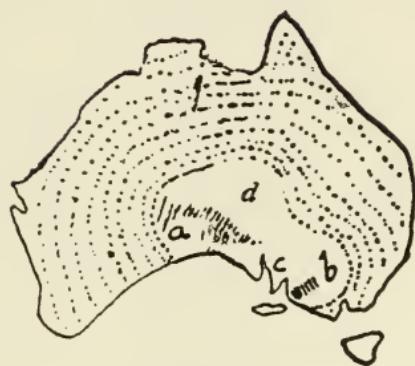
Map 71 shows the area of distribution of the Fire-tail and it would be thoroughly interesting to know its courses of migration. About Adelaide it will probably be bathic and in Tasmania, north-south.

PARROT-LIKE BIRDS IN TASMANIA

There are three quite differently coloured Cockatoos in Tasmania, a white, a black and a grey. The black is more numerous and has yellow cheeks. In Western Australia there is a black cockatoo very much like this one, with all the yellow displaced in favour of white. Map 72 shows this as western representation. Both are useful birds in eating out excess of timber-destroying insects.

The Grass Parrots stay in the open and barely approach the fringe of the forests. There are two species in Tasmania.

The Broad-tailed Parrots include the rosellas, and here again we have eastern and western repre-



MAP 82

The family of Tree-creepers (*Climacteris*) in
South Australia.

- a. Pale Rufous Tree-creper.
 - b. Lower Murray Brown Tree-creper.
 - c. White-throated Tree-creper.
 - d. White-browed Tree-creper.
- Waite's race of b (Loc. Cooper's Creek).
See F. E. Howe, Emu xxi., pt. 1; p. 41.
- f. Distribution of Tree-creepers over Australia
(spotted area).

sentation, a white-cheeked and a yellow-cheeked. The case is parallel with the Black Cockatoos, but the colour is reversed. Our common Rosella has the white cheeks, the yellow being on the western bird.

Map 72 states that 75 per cent of the Broad-tails are found in area C.

The Brush-tongued Parrots are the Lories, and they are sugar-eaters.

Tasmania has no representative of the very beautiful Long-tailed Parrots or of the Fig-birds. So far as the latter are concerned Tasmania has no fig forests for them to feed upon, and consequently no inducement for them to come.

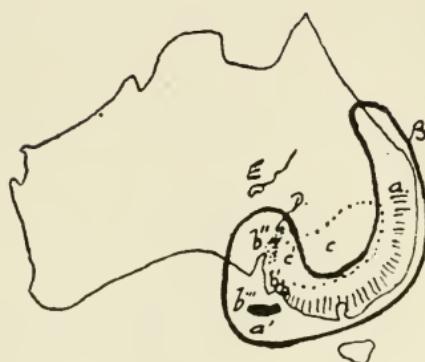
DIAMOND BIRDS IN THE SOUTH

(Plate 2, Fig. 73)

Tree Builders and Bank Builders.

By Diamond Birds we generally understand the genus *Pardalotus*. Some of them make nests in hollows of trees; the spotted species in rounded holes of creek banks. The eggs are white and inclined to be round, and for so small a bird quite large and numerous.

The Forty-spotted Diamond Bird is purely Tasmanian, giving preference to the highest timber in the wettest forests, map 73, "a." It is the smallest of the genus and is seen only by one man in a thousand, because of its diminutive size and great distance from the ground.



MAP 83

Parrot-like birds and their Races, in South Australia.

A—Glossy Cockatoo (*Calyptorhynchus viridis*).

 a. The species.

 a'. The race (Kangaroo Island).

B—Races of the Crimson Parrot (*P. pennanti*).

 b. Fleurieu Pen. Rosella.

 b'. Adelaide Rosella.

 b². Port Augusta Rosella.

 b³ (i.e. a') Kangaroo Island Crimson Parrot.

C—c¹ South Australian race of Yellow Parrot c (*P. flaveolus*).

D—Flinders Range Race of the Ring-necked Parrot (*Barnardius barnardi*).

E—Pale race of Yellow-vented Parrot (*Psephotus xanthorrhous*).

The Yellow-tipped Diamond Bird (*P. affinis*) is found as indicated in b. A diamond bird with a yellow speculum is also found in West Australia, confusing the distribution of the species. To the present writer it is a race rather than a species.

The genus has one peculiarity which we trace in the species *P. ornatus*. It is trimorphic, having a variable wing spot. In one bird it is red; in another, yellow; in a third, orange; all being broadly distributed.

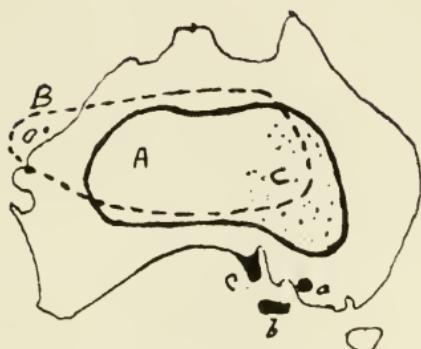
HONEY-EATERS (*Meliphagidæ*; meli, honey; phagein, to eat)

(Plate 2, Figs. 36, 74; Plate 3, Figs. 78, 79)

The honey-eaters make a family, the leading character being the bifid or brush like tongue. This gives them greater facility in gathering sweet juices from the flower glands.

The family is divided into twenty-four parts (genera) of which areas a, c, together in map 74 have nine parts. The interesting point is that each of these parts, with one exception, has only one species.

The distribution in this map bears a strong resemblance to that of map 73. From what we know of the expansion of bird areas, it would seem that the W.A. birds arose from those in Victoria (Bassian sub-region). These had their origin in



MAP 84

Dry-belt Cockatoos.

A—Pink Cockatoo or Major Mitchell (*Cacatua leadbeateri*).

B—Blood-stained Cockatoo or Corella; white skin round eye. (*C. sanguinea*).

C—Bare-eyed Cockatoo (*C. gymnotis*), blue skin round eye.

a b c—Mt. Lofty, Kangaroo Island and Eyre Peninsula races of Scrub Wren (*Sericornis*).

Queensland, the Torresian sub-region; Tasmania being the now isolated terminal.

Honey-eaters are everywhere in Australia; in the driest, in the wettest, in the warmest, in the coldest; though not breeding at so high an altitude as the Pipit. Some are modest in plumage colour, others beautiful in brillancy. There are numerous structural peculiarities, the Spine-bill of Tasmania, having the longest and most wonderful beak, while the Friar Bird is bare headed.

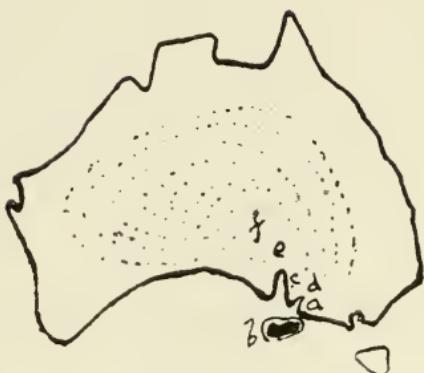
SOUTH AND CENTRAL AUSTRALIA

Areas 6—7

The areas 6, 7, map 1, are subject to a flood or a drought, a feast or a famine.

When an all absorbing drought has established itself in the back country of Australia most birds make an effort to get away, while others new to the country come along with the desperate hope of getting food and drink.

The last to hang on to the homestead supplies are the Chestnut-eared Finch, the Budgerigar Shell-Parrot and the Crested Pigeon. Tit-Warblers just exist in endless belts of mulga scrub, while Wren-Warblers get food and drink in the succulent leaves of salt bushes. The White-face (*Xerophila*) is evidently the most common bird over the wide tracts of southern salsolaceous country about Lake Gardner.



MAP 85

Wren-Warblers (Maluri).

- a. Adelaide Blue Wren-Warbler.
- b. Kangaroo Island Black-backed Blue Wren-Warbler.
- c. Port Germain Dark Turquoise Wren-Warbler.
- d. Peacock-backed Turquoise Wren-Warbler.
- e. Interior Light Turquoise Wren-Warbler.
- f. White-backed Wren-Warbler.

The Wedge-tailed Eagle thrives on the unhappy feeble turkeys and emus; taking toll of animals too weak for substantial defence. The Galah Cockatoo by careful search will find food in fallen seeds of salt bush and grasses. The Bare-eyed Cockatoo goes north to the better country of N.W. Queensland. Thousands of birds of various small sized species quietly stay beneath the low cover and no longer see the open or the early morning burning sun. Their food has gone and their present end has come. Their bodies just cease to be. The next flood will take a year or two to repair the destruction of feathered life and the erratic balance of things. Birds will lay twice the quantity of eggs in the season, and the waiting millions of seeds will germinate. The land is already again blossoming and yielding its prosperity.

The low-rainfall country between Victoria and South Australia has had the effect of making in the southern part of South Australia races derived from Victorian species. The uncertainty of many of these races remaining constant is deepened by the result of good seasons in the north bringing over by immigration quantities of the parent stock from other areas.

We find this in the Babblers, Tree-creepers, and Honey-eaters. The Blue-bellied Lorikeet is a race in Eyre Peninsula, and it annually migrates between Queensland and the Peninsula, via the Dia-



MAP 86

Two Honey-eaters with featherless tracts:

- a. Southern limit of Yellow-throated Friar Bird (*P. citreogularis*) absent from b; and larger and darker than in area c.
- d. Blue-faced Entomyza; absent in south-west, present in north-west (*E. cyanotis*).

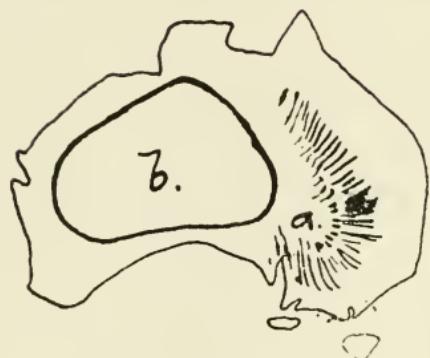
mintina River. The Rainbow Bee-eater does the same.

This appears to be the main line of migration for South Australian birds, map 75, a second line being along the Murray and Darling basins.

KEY TO THE DISTRIBUTION OF RACES

Our interest is invited to map 76 and its text. A robin is given as an example of a bird showing geographic differences according to the type of country in which it is living. It fairly well partitions South Australia into climatic and vegetarian differences. Flinders Range, the northern end of the South Australian highlands, has its direction north and south. As it passes northward there is a tendency for the birds to yield their coastal characters in favour of those of Central Australian birds. This is particularly so at the north end where the range passes through plains into the interior. The pittosporum and quondong (*Fusanus*) yield tender berries to berry-eating species, the acacias provide tough seeds for the strong bills of the Cockatoos. Native fuchsia bushes (*Eremophila*) attract the Pied Honey-eaters. Callitris, the native pine, shelters many birds.

Passing over porcupine bush the great interior is entered. The waterless mulga scrub and soft sand harbour the one common species, Thick-billed Thornbill; a bird living on insects for food and drink. In the dry grassed sandy open tracts an



MAP 87

Bower Birds in South Australia.

- a. Spotted Bower Bird (*Chlamydera maculata*).
- b. Yellow-spotted Bower Bird (*C. guttata*).

occasional Pipit or Bush Chat is seen. The granite ranges are best for the majority of birds. The endless dry water courses lined with red gums (*Eucalyptus rostrata*) harbour Diamond Birds and Tree-Tits.

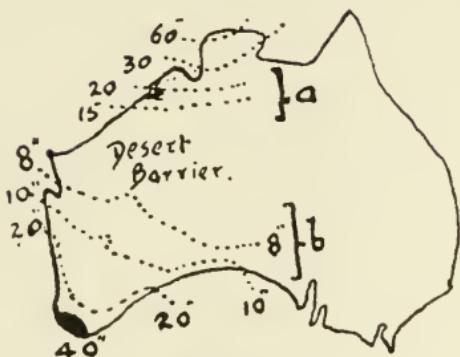
SOUTH AUSTRALIAN RACES OF TIT-WARBLERS

Many of the very small grey birds we see in the creek scrub, dry hill sides, or away in the hot country are Tit-Warblers. The common Yellow-Tail is one.

Together they make a very large assemblage or genus and as they have got into all sorts of country and stayed there, the colour of the plumage has come to be in sympathy with its surroundings. It then becomes a race. Map 77 shows the races, as well as we know them, in different parts in South Australia. They comprise a central southern group of races.

The race extending from Musgrave Range, A, to Murchison East, W.A., B, is remarkable in so far as it extends over one thousand miles east to west along an average rainfall zone of seven inches. In South Australia the vegetation is mulga (*Acacia aneura*) and it extends some great distance westward.

The Thick-billed Tit-Warbler (*A. robustirostris*) is about the only bird to be found over wide areas of this thousand miles. If there are any



MAP 88

Rainfall controlling distribution:

- a. Grass Finches (*Poephila*) Extensive Northern Australian family.
- b. Tit-Warblers (*Acanthiza*). Extensive Southern Australian family.

insects to be found it will get them. The whole family is noted for its insect eating ways and accordingly it is always placed among the most valuable of economic birds. K in map 77, is the tit-warbler that keeps to the samphire scrub of St. Vincent's Gulf; the vegetation, having had a controlling influence, has made a race of it.

VARIATION GROWS FROM EAST TO WEST

(Plate 3, Fig. 78)

Birds are like the hills in so far as they are always changing. Though time does work the change both take a long while about it.

The Brown-headed Honey-eater is in countless numbers in the Victorian forests, and is fairly uniform in colour. Getting towards South Australia it, at first, has a mallee change, then a, b, c, in map 78. Further west on the Nullabor Plain it becomes the western species with a white mark, d. This is quite an obscure honey-eater; difficult to know except when on the wing.

The Western White-eared Honey-eater, c, is differentiated from A, and the Kangaroo Island "a" is an island race of b, as c is a desert race of b.

In the coastal scrubs of Victoria and Southern New South Wales it is a common species. The nest is made of the hair of kangaroo or cattle, with grass inside. The eggs, excepting for a few spots, are white, which is uncommon in this family.



MAP 89

Desert barrier in operation; northern and southern races of *Melithreptus* (Honey-eater).

A—Brown-headed Honey-eater 1¹ *M. leucogenys*
1² *M. brevirostris*.

White-naped Honey-eater 1¹ *M. chloropsis*.
1² *M. lunulatus*.

B—White-throated Honey-eater 2¹ *M. albogularis*.
2 *M. laetior*.

Tasmania— Strong billed H.E. (*M. validirostris*).
Black-headed H.E. (*M. melanocephalus*).
Island Bl. head. H.E. (*M. magnirostris*).
M. gularis distributed over Australia.

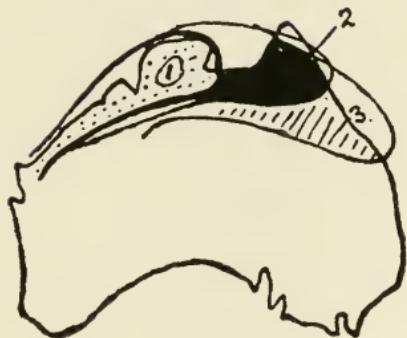
COLOUR GRADES

(Plate 3, Fig. 78)

1. Genus; 2. Species; 3. Race.

To know a bird and get definition we look quickly at the colours to see the scheme. After a moment's hesitation we decide the genus to be such or such; perhaps a genus of honey-eaters. The colour scheme may be spots, streaks or splashes, or definite solid areas that will change or vary in intensity among its species. These will always be true to colour, even if varying in quality. It is this variation in quality that gives us the race which is not quite the species. It shows a definite difference in colour or form due to differences in country or climate.

A good example of a species is given in map 79, 5, and its five races 4, 3, 2, 1, a, lessening in intensity from 5 to 1—a, 5 being larger than 1. It is the White-plumed Honey-eater. Another race is a, b, c, the Lesser White-plumed Honey-eater (*P. leilavalensis*). The points of interest are that it is a smaller bird than the southern bird and has a brighter coloured head. Both these points are in keeping with a law applied to nearly all birds having a long range of habitat north and south e.g. Cloncurry "a," Central Australia b, Flinders Range c. If it had extended south to 5 it would have lost its bright head colour.



MAP 90

The relationship with Northern Queensland e.g.:

1. Purple Kingfisher (*Alcyone pulchra*).
2. Mangrove Kingfisher (*Halcyon sordidus*).
3. Scrub Fowl (*Megapodius tumulus*).
4. White-browed Crake (*P. leucophrys*).
5. Yellow Oriole (*O. flavigularis*).
6. Finches (*Stizoptera*).
7. Partridge Pigeons (*Geophaps*).
8. Black-tail Tree-creepers (*C. melanura*).

CHAIN DISTRIBUTION

Mt. Lofty is one terminal, of distribution of the Red-browed Finch, map 80. The bird, having a browner head than the Bassian one (Vic.—N.S.W.), becomes a race of it. The Cape York bird, 5, is the smallest of all the species and becomes the Least Red-browed Finch.

The largest is found at 4, where birds usually are larger. It is the most numerous of all the finches and makes the largest nest, which is bottle shaped. This small bird lays six pure white eggs. The young has a black bill and dark eye brow during the first few months, after which it becomes the "wax bill" with blood red on the rump and eye-brow.

It is occasionally the foster parent of insect-eating cuckoos and helps to prove to us that seed-eating birds feed their own young on insects.

ZEBRA FINCH AND ITS RACES

Finches of the several species live in very different kinds of places and in many ways. In Europe the true finches prefer the timber, the buntings the open, the snow-finch the coldest country, the highest mountains the bull-finch, while the desert has its types.

The canary finch is a song bird, which is unusual with finches.

The Redpoll of Europe and Asia is the greatest of emigrants, leaving the Arctic just before the



MAP 91

The relationship with Southern Queensland e.g.
Ground Wren (*Hylacola*).

snow falls and getting into Africa and India after the monsoon.

The Gold-Finch is an imported bird and well established.

Among the Australian finches the Zebra or Chestnut-eared Finch is the most widely distributed. Its stronghold is in the south east, map 81, "a," and it varies in plumage all over the continent according to the physical conditions. It comes of a happy family. At the close of day a dozen will sleep in the same nest; a bottle-shaped loosely built house of grass. A pair will build in the lower sticks of hawk's nest and in fourteen days the young hatch out like little hairy creatures with no sign of feathers. After they join the nearest flock they get fed by the nearest bird having anything to give away. These young birds, hatched in October, will have their own young in March. After a decent rain every "zebra" that can lay eggs does so, and the winter sees an amazing cloud of them.

THE FAMILY OF TREE-CREEPERS (*Climacteris*)

(Plate 1, Fig. 28; Plate 3, Fig. 82)

There is one general or three minor colour-schemes in Tree-creepers. Four species are found in South Australia, map 82, a—d.

The family is represented in every part of Australia. Three species in South Australia have their



MAP 92

The Great Interior (Rainfall: 3.5 inches poor season;
20 in good season).

Well-known examples:

1. White-winged Wren-Warbler (*M. cyanotus*).
2. Cinnamon Ground Bird (*C. cinnamomeum*).
3. White-faces (see map 92).
4. Crested Wedge-Bill (*Sphenostoma*).

terminals at a, b, c. The species d is found in the centre of the continent.

The Rufous species is the western representative of the Brown species. The rufous seems to be the result of the particular country acting on the brown plumage! The young of the White-throated species has its upper tail coverts rufous, which entirely disappear with the next moult. What is the relation to the rufous species? Can it be the remnant of a sporadic migration from the desert! The forest would have the tendency to obscure its rufous and convert it into grey. In some species, the young, the male parent and the female all differ in colouration.

In the Red-browed species it is the female that is more beautiful in plumage than the male, a revision of the sexual law in relation to colour.

They have their food beats, travelling along a line of trees in the morning, and returning in the afternoon.

PARROT-LIKE BIRDS AND THEIR RACES

Anyone leisurely walking a hundred miles across country will emerge from one forest with one type of bird to enter another containing a race of that species.

He or she, may pass from the southern mallee to the northern part of it, and there see a race of the species previously seen. It is quite possible when passing from the mainland to an island to find on it



MAP 93

Distribution over Australia.

Migratory.

Nomadic.

Local.

a race of the well-established mainland species. If one leaves Flinders Range and enters the Eyrean desert he will surely find a race of the bird observed in the range. Map 83 indicates examples.

The Glossy Cockatoo of the Australian Alps changes in shade when it becomes an old inhabitant of Kangaroo Island.

The Rosellas belonging to the section of Crimson Parrots are referred to in b, b¹, b², b³.

The Yellow Parrot, c¹, that the Adelaide district gathers to itself, has its stronghold in c. The climate is not the same, neither is the tone of plumage.

All these parrots feed in different types of country, on different forms of vegetation, and racial shades approximate to the surroundings.

One change takes longer to make than the whole of the allotted span of man's life.

DRY BELT COCKATOOS

Dampier in 1699 was the first to discover cockatoos. On the western coast of Australia, A, B, C, congregate. Because of the mountain range and another type of food upon the eastern coast, they do not approach it. Map 84 shows that the distribution is more central than littoral.

The Pink Cockatoo is a lover of the desert, frequenting the native wells morning and evening. It is the most beautiful of the "white section" when its picturesque wings are fully exhibited.



MAP 94

Irregular origin.

Map 84, B, shows the habitat of the Corella to be extended to the Dampier Archipelago. It associates in flocks of thousands on Cooper Creek and the great northern plains, even to the number of fifty thousand at a time. If there is any preference it is for the damp fields of Coolibar or Flooded Box (*Eucalyptus*). A horseman travelling through the desert towards evening will watch the gleam of wings and eventually find the water hole. In one tree near that hole quite 1500 birds will settle: in the other trees the grand total of 75,000. Drought is the reason of such a vast congregation round one water hole; probably the last drinking hole in that district. It feeds on roots using its splendid bill for this purpose.

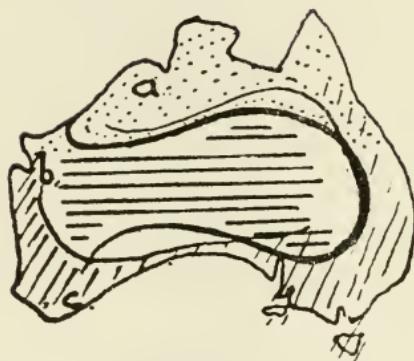
C, in map 84, includes the area of distribution of the race *Ashbyi*, north of the silver lead Barrier Range.

SCRUB WRENS (*Sericornis*)

(Plate 3, Fig. 84)

Scrub Wrens are local with a love of tangle and a dislike of the open. Rank vegetation appeals to them. The two kinds in this part of Australia are the Spotted and the White-browed. Then follow innumerable differences in plumage according to the type of forest and its locality, and these geographical differences make races.

In South Australia we certainly have three races



MAP 95

Colour tri-section: three principal groups of
Wren-Warblers (Malurus).

- a. Red-backed Wren-Warbler.
- b. White-backed Wren-Warbler.
- c. Blue Wren-Warbler.

about Mt. Lofty, Kangaroo Island, and Eyre Peninsula, map 84, a, b, c.

The nest is generally placed low to the earth. Each morning, for half an hour, building operations are carried on, while the grasses are pliable with dew; 6 o'clock being the time to start. Work may not be quite suspended before 12 noon, when an adjournment is made to 6 a.m.

On the seventh day an egg is laid, a second on the ninth and a third on the eleventh. On the fourteenth the bird firmly sits. The eggs are laid on the forenoons and the young hatch out on the twenty-third day from laying the last egg. The young fly on the fifteenth day from the breaking of the shell.

Next day the young and old begin a nomadic life.

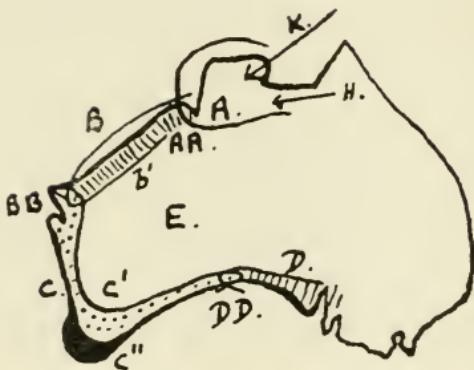
WREN-WARBLERS (Maluri)

(Plate 3, Fig. 85)

Races of birds in South Australia have been emphasized in the preceding pages. In map 85, a—f, we get an impression of the distribution of a genus in South Australia, and if we examine the altered country near each species we will again find races.

Wren-Warblers are without doubt among the most resplendent of red, white and blue birds, with attractive ways and pleasant voice.

They moult their colour in the Autumn and get a fresh set for the Spring. The hen is always



MAP 96

Normal Areas.

A, Northern; B, North-Western; C, Western;
D, Southern; E, Central.

Junction areas: A A; B B; D D

The arrow K indicates one direction of annual
immigration from Papua.

The arrow H indicates direction of earliest
migration to populate western areas

brownish and the young begin as browns. These hatch out in fourteen days, and leave the nest on the ninth or tenth day after being hatched.

The white-backed section keeps more to the interior, with its salt-bush and cotton-bush plains.

SOUTHERN YELLOW-THROATED FRIAR BIRD

BLUE-FACED HONEY-EATER

The Friar Bird, or Leather-head, is one of the large honey-eaters without feathers on its cowl-like head.

It is a bird with an abundance of confidence in itself, as it will continuously steal from orchards unless effectually stopped. Map 86, a, approximately shows the southern limit of its range from north to south. It is a bird of the warm inland parts and gets smaller in size the further north it is found. In the several islands off northern Australia there are a number of species of Friar Birds and there are a number of other birds (Orioles) mimicing them. It is a good case of protective mimicry; the weak resembling the strong in colour.

The Blue-faced Honey-eater is also an interior species, not passing the Great Divide in the south. It is large bodied, with a brilliant blue green face, and may be considered a handsome bird. In the breeding season it has the rather strange way of using the nest of the Babbler by building its own



MAP 97

Unusual combination of species and areas: Coastal and Eyrean (inland).

inside. It has the impression that might is right, as it steals piecemeal, or as a whole, a nest of the Babbler or Miner. It may even add to it while under construction by the rightful owner. It has two families in the season.

BOWER-BUILDING BIRDS

The Cat Bird and the Regent Bird of the tropical coastal scrubs of New South Wales and Queensland are included in the bower builders. The Satin Bird is found in the Otway Forest, having extended westward from the extra tropical coastal land.

Several species of bower birds are found in the dry interior and the northern fringes of it. Among these are the two shown in map 87, a, b. The leading characteristics of the family are the playground and beautifully marked eggs. Among the pines and bullokes, or beneath a bursaria bush, there may be placed on the ground a structure of twigs.

This would be quite two feet in length, with heaps of bones and coloured things at the ends. Quondong berries and bright feathers would be conspicuous. As many as a thousand bones have been accumulated.

Each time a bird comes to play it brings a shell or other thing. Some land shells are most conspicuous. They enjoy the play each morning just as other birds enjoy their less attractive games. It has become a pass time in a fixed place, and in a building made by themselves for the purpose.



MAP 98

Wide-spread Groups { Day-flying Sea-birds.
 { Night-flying Sea-birds.
 { Inland Groups.

- A—The most southerly nesting ground of tropical sea-birds (Noddy and Sooty Terns), and northerly nesting ground of petrels.
- B—The nesting grounds of Penguins and Southern Geese (*Cereopsis*).
- C—Pipit (*Anthus*): races c¹—c⁵ according to the colour of the ground.
- D—The northern and eastern habitat of the greatest petrel, the Kerguelen Albatross (*D. chionoptera*).

WESTERN AUSTRALIA

Areas 9—7⁹, 8—7⁸

1. The bird fauna of the north is divided from the south by a desert. The origins of nearly all the families in a and b, map 88, are separately derived from the east of Australia, along a northern line and a southern one; along the rainfall zones of 20 inches and 10 inches. In the latter case, prior to the subsidence of the Australian Bight old coast line, the rainfall was more in keeping with 20 inches.

Some of those birds used to living in a forest of 40 inch rainfall in south-east Australia, gradually went west. They are now preserved in the small area of 40 inches in the south-west. Those birds in the links between, through not accommodating themselves to the wearing away of a 40 inch rainfall coast in favor of a 10 inch zone, died out. Thus we get eastern and western representation of a species with a broad gap. The less specialised birds of b worked up the coast from Perth and Geraldton districts to the Ashburton country with an annual rainfall of 8 inches. This is their northern limit.

2. The northern line of expansion, "a," from Queensland, was as much coastal as the southern line, but with different types of birds. Here we have the genera of a moist hot coast line, and the finches of the parallel extensive grass lands.



MAP 99

The Coastal Range; a barrier to distribution

1. Coastal: Western Scarlet-breasted Robin; White-browed Spine-bill; Long-billed Honey-eater; Moustached Honey-eater.
2. Ultramontane: Crested Bell Bird; White-winged Wren-Warbler; Chestnut-backed Ground Bird; White-browed Chatterer.

These birds go south and meet the southern species between the Gascoyne and Ashburton Rivers.

3. Inland from the whole of the coast of Western Australia we meet dry country birds with a tendency to be paler in plumage than the coastal birds. In the ground loving birds the colour will be according to the type of country upon which the bird is living. This is where we find colour protection on a grand scale.

4. The outland or island fauna is rather remarkable. The Houtman Abrolhos e.g. are made up of the most southerly coral islands in the Commonwealth, and they are the meeting ground of myriads of northern terns and southern petrels. Here they nest in thousands, the first on the ground the second below it in burrows.

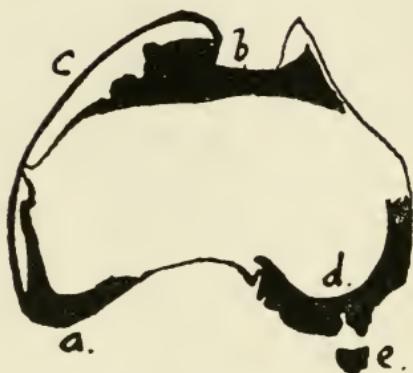
DESERT BARRIER IN OPERATION

Birds of the north-west.

Birds of the south-west.

Where there is a great desert there is no natural facility to cross it. The tendency is to act as an obstruction rather than to encourage travel or expansion. The migratory birds offer no objection, as they journey miles above it, and close on a thousand miles before alighting.

With local birds of internal migration it is a very serious matter when a dull broad stretch of



MAP 100

Black Cockatoos:

- a. White-tailed Cockatoo.
- b. Great-billed Cockatoo.
- c. Red-tailed Cockatoo.
- d.
 - {} The Black Cockatoo.
 - {} Banksian Cockatoo.
 - {} Glossy Cockatoo.
- e. Yellow-eared Cockatoo.

weary foodless land is met. They simply do not carry on and in this way we get a barrier as shown in map 89, 1¹ 2¹.

Many species travel westward from the Carpentaria country with the hope of getting south of the great sand-central.

On the Nullabor Plain in the Australian Bight many birds have travelled westward with the embryo hope also of going north; getting a similar set-back in a similar form of trouble. Thus we get two faunas separately kept apart. This is shown in the text of map 89 by the example *Melithreptus*, a genus of honey-eaters containing millions of individuals in the four corners of the Commonwealth.

RELATIONSHIP WITH NORTHERN QUEENSLAND

The birds of the northern portion of West Australia are closely related to those of North Queensland. Map 90 means that the birds of areas 8 and 1, map 1, are the birds of 2, 3, 4, while the birds of 3, 4, 5 have many species different from each other, and a great number not found in 8, 7⁸, 1, 7¹. Area 2 is the fountain head from which arose the birds of areas 1 and 4. All these areas have a few species quite their own, and for that reason they have their own identity. The text of map 90 gives examples of birds commonly found only in 8, 1, 2: (1, 2, 3).



MAP 101

The north-western sea-line, and distribution of its
principal birds.

The two most interesting birds found only in areas 8 and 1 are the Rock Pigeons (*Petrophassa*) and Rainbow Pitta (*P. iris*). The Pitta is derived from area 1.

The Carter Desert Bird is not found outside of 8, 7⁸, and is the only genus, among a number, that has the nearest relative in India.

In area 8 the desert approaches the sea, and the family of Bush Larks (*Mirafra*) takes on the plumage that agrees with the surroundings; cinnamon, grey, or pale brown. Bush Larks, with the loveliest voices in the noon of night, are found all over Australia.

THE RELATIONSHIP WITH SOUTHERN QUEENSLAND

Nearly all the birds of South-west Australia are more closely related to the birds of Southern Queensland and New South Wales than to the birds of any other portion of the Commonwealth. They have travelled along the coastal lands, or by means of the Murray River system, or in a lesser degree by the Lake Eyre system. A general convergence is noticeable about Port Augusta. Continuing the journey they travel through salt bush and across the Nullabor Plain into the further west.

The Ground Wren (*Hylacola*) map 91, is a good example of a species taking centuries to travel on and on in coastal types of wooded land.

The Purple-crowned Lorikeet is a good example of a strong quick flying bird that could easily take a northern course from Queensland to West Australia, but has not done so. The Ground Parrot (*Pezoporus*) has travelled from near the border of coastal Queensland around Port Phillip and Port Augusta to the port of Perth. The Field Wrens (*Calamanthus*) not only take the coastal course of expansion but in addition they have worked inward from Port Augusta to Lake Eyre.

The general tendency of all these birds of the east is to become paler in the west, excepting the few confined to the wet forests of Southern Queensland and South-west Australia, e.g. Bristle Bird (*Sphenura*).

THE GREAT INTERIOR

(Plate 3, Fig. 92)

The vast hot furthest back country of this island-continent is a land of nomads, living under conditions more or less desert like, suitable only to the fit. Under this head are placed in the text of map 92 examples of capables weathering through great stress of drought. More often than not they are short of food and living under the necessity of travelling long distances on short notice.

It is rather wonderful that so frail a bird as the Wren-Warbler is able to live for months in a waterless land, getting its drink in its food, and

very dry at that. There is in the mulga country a Tit-Warbler that passes through a drought when every other bird has gone: migrated or starved. The bright prospect in the break of a drought is the multitude of regular nomads that quickly come in to feed and breed, until again forced out.

A good season makes the country capable of carrying innumerable seed-eaters, insect and native fruit-eaters. Geographical distribution is now broad and variable. Flocks of pigeons and quail travel over ground never before flown across by that generation. They wander up creek beds that have been dust bins for years, and now have difficulty in keeping their feet dry. Large families are produced, and the great interior is again a flower picture; a garden with the hum of insects and a wealth of dry-country bird life.

DISTRIBUTION OVER AUSTRALIA

(Pl. 3, figs. 93, 98; Pl. 2, fig. 35; Pl. 1, fig. 32; Pl. 3, fig. 84)

True migratory birds fly over and beyond the continent of Australia from north to south in September, and from south to north in April. They have a wing pattern that serves them well in their long flight to Siberia.

The Bronze Cuckoo, map 93, also flies through Australia, but keeps to it. It has a wing less specialised for so long a journey as the sand-pipers make.

The quail are nomads, travelling in directions

which may vary in quantity and quality of insect life and seeds, just as thousands of water birds do, when their swamps dry out (*Tribonyx*).

The Crow and the Pipit are well distributed, the former being local in large areas extending to a third of the continent. The latter is constant to limited areas e.g. the height and depth of a mountain, or a plain between two mountain ranges, or small portions of an indefinitely unbounded plain. Several species are local in the southern summer, and local in the north in winter (Chats).

The Magpie-Lark and Scrub-Wrens are local throughout the year. There are thirty species of purely Australian birds commonly found over Western Australia and all over Australia. To these might be added approximately another thirty species which come in from Asia, to spend the six summer months in Australia.

IRREGULAR ORIGIN

There is a bird in the far north-west living away from most other birds, by name the Carter Desert Bird (*Eremiornis carteri*). If it has company we may conclude it is the Bush Lark (*Mirafra*). Both these birds have an African origin, via India, but they do not seem to have immigrated into Western Australia by way of Northern Queensland. The Desert Bird is found only in N.W.A. though I suspect it was once in the west of the Northern Territory coming across direct from Timor. The Bush

Lark probably did the same, and more; viz., spread east and south, and west, taking on the colours of the deserts and fitting in with difficult conditions; map 94.

The Desert Bird belongs to the family of Warblers and is not unlike our Reed Warbler; though its nearest relative (*Schoeniclus*) is in India.

COLOUR TRISECTION

(Plate 3, Fig. 85)

If one could get a mental picture of the finest colour distribution amongst birds in Western Australia, it would seem to be red, white and blue, as indicated in map 95. These are the Red-backed Wren-Warblers, "a": the White-backed Wren-Warblers, b; and the Blue Wren Warblers, c.

It is an interesting colour range on three types of country extending tremendous distances. Within each separate distance the blue will alter, e.g. from light to dark turquoise, or the bird will take on a purplish back. The reds will weaken when they are found in areas 7, 8, map 1.

There is a general tendency in Eastern Australia, between Torres and Bass Straits, for the birds of any one species of any family to have three grades of colour, a northern brilliancy, a southern dullness, and just beyond the tropics a medium standard. The silvery cobalt of the Northern Wren-Warblers, grades into the deep cobalt of the southern Wren-Warblers.

NATURAL AREAS OF WESTERN AUSTRALIA

Centuries have felt the influence of birds living in definite areas, all the year round, or migrating to and from them annually.

These areas having different types of vegetation have many forms of birds. So marked are they that millions of finches will feed on grass seed in one area, thousands of lorikeets on honey-bearing flowers in another, and innumerable scrub birds in forests of different types having different kinds of insects.

Climatic effect, as in map 96, B b¹, will produce colour tone, and if the particular birds are internal migratores they will annually return to the area of their birth.

Birds mostly come in from the direction of New Guinea or come south from the Northern Territory, map 96 K. The lines of immigration indicated in H and F have been previously mentioned.

The great junction areas A A, B B, D D, are the boundaries of the mass of species in Western Australia.

At Nullabor Plain, D D, we have the meeting ground* of birds from South Australia and birds from Western Australia, both sections keeping apart: the latest discovery among parrots being the

*Address to the R.A.O.U. Perth Congress, 1920, R. Hall.

Naretha Parrot of H.L. White, keeping to the western side of the plain.

B B is where the northern and southern birds meet, and A A is where the real tropical birds refuse to go beyond. The few dry-country species of birds locate themselves at E.

UNUSUAL COMBINING OF AREAS

(Plate 3, Figs. 84, 90)

The country between the Gascoyne and Ashburton districts is a no-birds land. Most of the species north of it do not go south, just as we find the reverse. Migratory birds are excepted.

The Tit-Warblers (*Acanthiza*) and Scrub-Wrens (*Sericornis*), embracing fifty species and races, are with one or two exceptions, all southern.

A bird connecting these two genera by its plumage and habits is the Red Throat (*Pyrrholaemus*). Strangely enough it is found in both areas, extending to New South Wales in the south, but not extending in the north to Queensland.

As a set off against this theory of a south east origin we have the Brown Flycatcher (*Microeca assimilis*) distributed over the whole of Western Australia as shown in map 97, and having a north-east origin. These are coastal examples of birds being common to the two coastal areas.

In the inland sub-region (Eyrean) 7⁹, 7⁸, map 1, we have the Rufous Tree-creeper as a good example of a species occupying the three areas

N.W.A. 8, S.W.A. 9, and the desert west 7^8 , 7^9 (map 1).

Among the interesting birds of the area 8, we have the only cuckoo in Australia which makes a nest and hatches its eggs; the Pheasant Cuckoo. So that of the twelve species of this parasitical family this one stands out for morality in relation with its fellows. Having a measurement of close on two feet it is a giant of its kind.

WIDE SPREAD GROUPS

(Plate 1, Fig. 9; Plate 3, Fig. 98)

At the point A in map 98 we meet with a great climatic change, both sea—and land—birds responding. The extensive family of Terns, straight-billed gulls, keeps mostly to the north, while the equally strong family of Petrels keeps almost altogether to the south. The Houtman Abrolhos, A, is the nesting ground of both, and it is the most southerly group of coral islands in the southern hemisphere. Stray penguins will come from the south on rare occasions. They prefer the Leeuwin coast and islands east of it, which are about the northern limit of range. The Recherche Islands are good hatching grounds, after which the penguins go to sea for months. They are nocturnal as well as diurnal.

Terns lay their eggs in open places, Petrels mostly in deep hollows of the ground, and Penguins in open places amongst rocks or slightly in the ground.

The Cape Pigeon, which is a petrel, is beautifully mottled and lays its eggs in open places on the rocky cliffs. I have camped with them during a blizzard on Kerguelen's Land. Occasionally it gets as far north as King George's Sound but not to lay eggs, as well as we know. The Snow Petrel, which is one of its fellows, never leaves the Antarctic Sea to nest. The smallest petrel (Wilson's) and the Giant Petrel, annually spend the winter about our shores. They are circumpolar.

Of the land group most widely distributed species we have the Pipit and its races. It is a protectively coloured species, being rufous on red areas, brownish on brown, and greyish on grey. This is shown in map 98, c, c¹—c⁵, and collections of birds will define the colour of the country on which they live.

Mirafra, the Bush Lark, is just such another bird distributed over Australia and varying with its country.

THE SOUTH-WEST AREA

(Plate 2, Fig. 74; Plate 3, Fig. 99)

The south west area is divided into two portions. There is the coastal plain, a narrow strip of country west of the Darling and Stirling Ranges, and there is the larger portion east of the ranges, with a scarp dividing two vegetations; map 99.

To all small ground loving birds the range is a barrier to distribution eastward. Having a feeble flight they do not seem to care to leave the vegeta-

tion of the lowland to cross a mountain range thinly covered with low-growing plants.

All the coastal species in the text of map 99 are found only in south-west Australia. The robin has a small white frontal mark, originally pointed out by the ornithologist, A. J. Campbell, while the scarlet-breast of Eastern Australia has a large white frontal mark. The Spine-bill of Eastern Australia has no white brow, so that the development of a white brow in Western Australia is interesting. This is an example of what is continuously occurring amongst birds.

The Ultramontane birds mentioned above have no barriers to migration eastward for thousands of miles, with the result that they have a broad distribution. The Darling Range divides the country into western moist and eastern dry. In the latter we have the Red-capped Robin which puzzles us greatly by taking on a partly red throat, often skipping a generation or two. It lives in the jam country (*Eucalyptus*) a loose inland forest, while on the coastal side another robin frequents the giant jarrah country (*E. marginata*). The Bronze-wing pigeon is an instrument of distribution for the seeds of the "jam trees," while the honey-eaters which associate in the high foliage of the jarrah and karri gums cross fertilise the trees. Many other proofs of this means of dispersal occur in the

different types of the coastal country. The latter country is divided into:

1. Limestone hills with dwarf scrub.
2. Sandy moist land with red flowering gums, tea tree, and grass trees.
3. Granite and ironstone ranges carrying the jarrah trees.

Each class of country in the south-west area bears its own species, and its own races of them, adjacent.

THE BLACK COCKATOOS

The cockatoos that are black have recognition marks of red, or white or yellow. The only one with white keeps to south-west Australia, and the one with yellow to south-east Australia. The bird with red in its plumage, map 100, c, connects a and b, and is found in Central Australia. The Tasmanian bird is an insular race of d. The Great-billed Cockatoo is found only in northern Australia, from west to east.

The female appears to do most of the nesting, while it is expected of the male that he will feed her. She leaves the hollow tree in which are placed the eggs, and settling on the branch welcomes her mate. She is then fed, and immediately preens her feathers. Ten minutes later she re-enters the nest, tail first, and a few weeks later the young have to climb upward, six feet, in many cases. There are two young, and as one is born about a week later than the other, it rarely is strong enough to do the

climbing. That is, it dies before maturity, as the grubs generally go to the strong.

The young of the White-tailed species may travel with the parents as far north as the Ashburton River, though it is more at home in the magnificent forests of the south-west.

THE NORTH-WEST SEA LINE

(Plate 2, Fig. 45)

The north-west sea line is somewhat similar to the north-east one, though not so rich in coral reefs, or reef birds. There are those birds which keep to the sand beaches, and many others common to the mangrove estuaries.

The Reef Herons are endeared to the atolls. Many land birds cross the narrow sea to the low lying islands. Petrels of the south rarely come so far north, excepting that fine bird the Black-billed Albatross of Lord Rothschild. It is so rarely seen that we wonder if it is not the rarest of all the tube-nosed birds. The "mutton-bird" is a type of petrel that is said to migrate to the Japanese seas using both dark and sunlight. Their nesting is mostly nocturnal, a necessary evolution because of daylight enemies, as skua gulls.

The commonest of all our sea birds is the Noddy Tern, found on the Houtman Rocks in nesting time, and along the equatorial waters to New South Wales. Elegant Tropic Birds, with attenuated red-tail feathers, and great Frigate Birds lend charm to the tropic seas of the north-west coastline.

ERRATA

- Map 46—Reverse f and g.
- „ 52—d equals “Stronghold.”
- „ 74—To M. garrula add Tasmanian race.
- „ 77—“South” not Southern.
- „ 91—Transpose Maps 91 and 97.
- „ 97—Transpose Maps 97 and 91.

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